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Market Regulation & Profitability:
Empirical Evidence from the Airline Industry

Johan Hedin & Mathias Krüger

Graduate Business School
School of Economics and Commercial Law
Göteborg University
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Abstract

The process of globalisation has been a widely discussed topic over the past two decades, and a great enabler and driving force behind this process has been the airline industry. In addition, deregulation is said to have a great impact on company performance and profitability, and is often associated with being a direct consequence of globalisation.

This paper examines the US and the EU airline industry with the intent to test the consequences of deregulation. We document that the two regions deregulated their respective markets differently in time; the US deregulated in 1979 and the EU gradually from 1985 to 1997. We test the two markets concerning profit margin, before and after the final EU deregulation in 1997. The evidence indicates that US airlines have a higher profit margin than their European counterparts, both before and after the EU deregulation. In addition, we find no indication that the EU airlines improved in profitability after the final deregulation. Finally, we find that different variables affect profit margin differently in the two markets.

Key Words: Market Regulation, Profitability, Economies of Scale and Scope, Capital Structure

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Göteborg, December 2002

Johan Hedin & Mathias Krüger

Table of Content

Table of Appendix

Table of Figures & Tables

1. INTRODUCTION

1.1 Background

A widely discussed topic in late economics is “globalisation”. Globalisation is often attacked or praised as a thing, when it is in fact a process. It’s a process of accelerating integration and combined national economies, through growing streams of trade, investments, and capital across historic borders. These streams, in a broader sense, include organizational skills, technology, ideas, information, entertainment, and popular culture. More recently, globalisation also includes financial trade and monetary policies through economic unions. According to Yergin, Vietor and Evans (2000) the aviation industry is one of the great enablers of globalisation; but, as an industry, it is a laggard in adapting to globalisation due to the peculiarities of its organization and its half-century of national and international regulation.

A more open world with lower barriers across borders can lead to major opportunities but also significant challenges for companies. Whether they stay alive and grow depends not only on the opportunities but also on how they react to the challenges in a world of intensified competition. National borders nowadays provide much less protection than they previously did. The intensified pressure steaming from globalisation is also a reaction from global shareholders, while technology and the Internet are adding to the pressure.

Further, Yergin et al (2000) stress that a natural development for companies following the globalisation process, inescapably, is a drive for scope and scale. Scope and scale often permit companies to serve customers more broadly and better, it enables companies to bring down costs and to spread them over a wider base, for the purpose of being as competitive as possible in as many parts of the world as is feasible. Scale also provides evolution of firms internal knowledge and management systems. Further, scale economies enable companies to spread their brand over a larger geographical area. Scale, by definition, means bigger companies, and that means consolidation in the aftermath of falling barriers to trade and investment. These forces help to explain the sharp rise in domestic and cross-border mergers over the last decade.

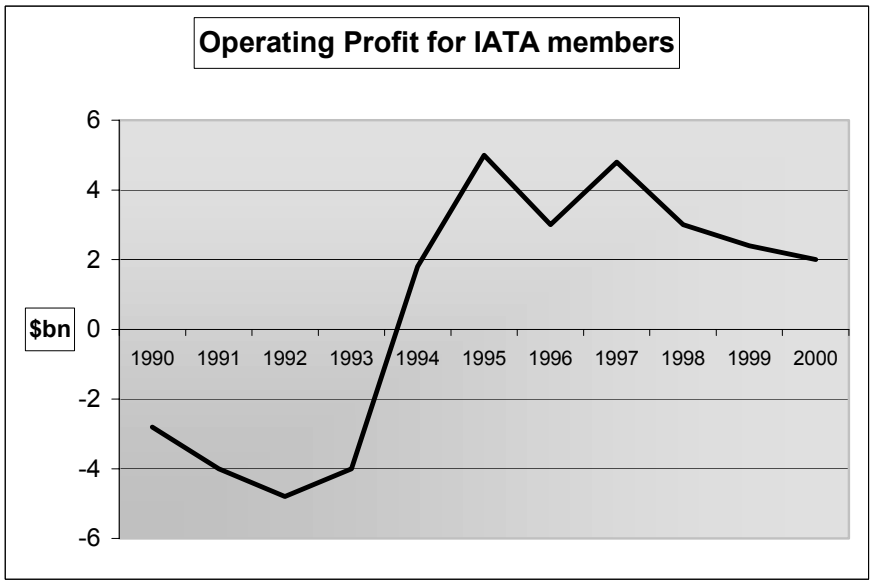
This paper investigates the US and the European airline industry and the effects of deregulation. The globalisation has driven competition to another level, and efficiency is a key factor for survival. As deregulation started in the US in the late seventies, the market has become very liberal concerning the competitive environment. The US airline companies have over a longer time than their European counterparts, been forced to adapt to this fiercer market condition. In Europe, national regulations and political interests have limited both competition and consolidation between airline companies. In contrast to the US, Europe has lagged regarding these regulatory settings. The drive towards globalisation, with the European union adding speed to the process and the intensified pressure on individuals and companies to perform better, will lead to significant changes. With an overcapacity of approximately 30% (Veckans Affärer, 2002), the established airline industry is under pressure, and changes will happen, but what factors will really improve firm performance?

1.2 Problem Discussion

The airline industry is a controversial industry with its ownership structure, subsidiaries, and protectionist strategies. Alliances have emerged as a result of the regulated market conditions, and the airline industry has been a leading industry regarding alliance making and an icon for many others. The problem is just that the alliances themselves have with a few exceptions, been as short lived as an average Scandinavian summer (Veckans Affärer, 2002). According to Yergin at al (2000), alliances represent an initiative by individual airlines, although an imperfect one, to rationalise their operations, build more effective market coverage, and offer more seamless, hassle- free transportation. Alliances have emerged in an attempt to get round the regulatory barriers that restrict every airline's ability to acquire or merge across national borders. Fundamentally, the formation of alliances reflects the airline industry's effort to develop its natural network-based structure within the limits imposed by government regulations.

During recent years, and especially after the 11th of September 2001[1], profits have fallen and bankruptcy hit, or been close to hitting, far too many of the established actors (exemplified by the financially troubled Alitalia, and the total collapse of Swissair). In addition, during the past years, low-cost airlines[2] have challenged the established actors on mostly single routes to popular destinations.

The September catastrophe was, by the airlines themselves, given much blame for the late economic downturn. Nevertheless, the market trends were in fact slowing from the late nineties. The annual growth in passenger traffic has fluctuated around 5% during the entire nineties and operating profit was declining at the end of the millennium. Figure 1.1 clarifies this trend and shows the total profit for IATA[3] members.



Source: IATA, 2002

Figure 1.1 Average profit margins

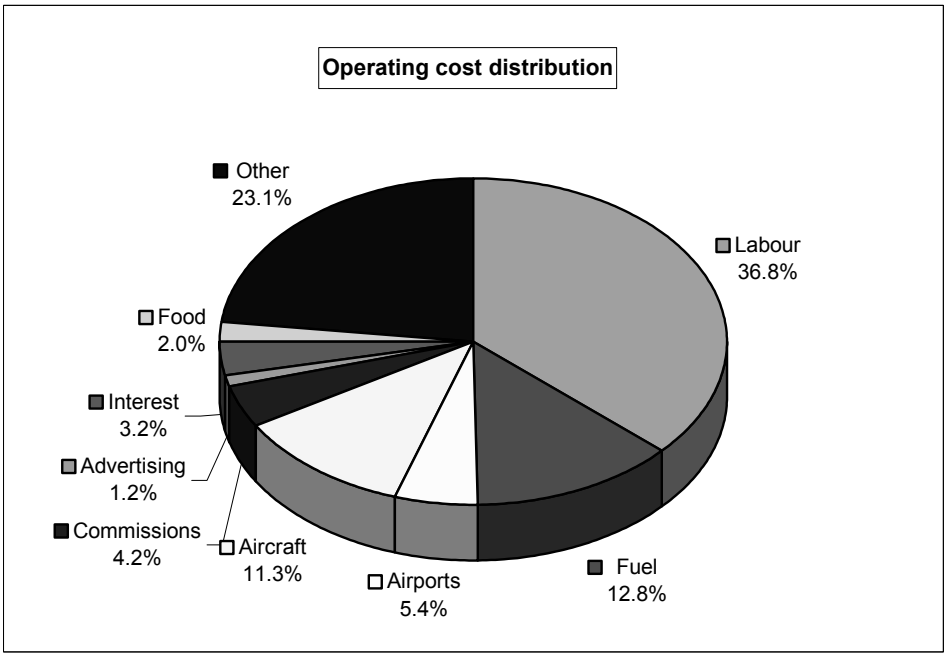
These changes in growth, market conditions and profit might also have changed the variables affecting firm performance. When size and capacity might have been the great advantage in the early nineties, cost effectiveness

[1] Terror attack on USA (World Trade Center, NY etc) 11 September 2001.
[2] Low-cost airlines such as Ryanair, Easyjet, GoodJet.com, Sterling and Crossair, among many others are competing on few and carefully chosen routes.
[3] IATA (International Air Transport Association) has 280 airline companies as members, approximately 95% of all international scheduled air traffic. IATA is a international organization, who's mission is to represent and serve the airline industry

could be the important one after the deregulation. An interesting question is then; is it possible to capture variables affecting profit margin in the airline industry. Further, since the EU deregulated their market later than the US, will there be different variables affecting profit margin in these two markets?

1.2.1 Cost Structure for Airlines

The airline industry is relatively homogeneous, as they sell seats and cargo space with the intention to transport from one place to another. Hence, there is not much room for differentiation. According to the Air Transport Association (2002), the airline industry is a very cost intensive industry, with huge initial investments ranging from expensive equipment and facilities, to airplanes and flight simulators, to maintenance hangars. Further, labour costs are huge, approximately 37% of operating costs, since both service and maintenance are crucial and mostly regulated by law. On average 11% of the labour costs are for maintenance. The industry is also very sensitive to changes in fuel prices, which account for almost 13% of operating costs on average.



Source: Air Transport Association (2002)

Figure 1.2 Operating cost distribution among airlines, 2002**.**

A natural interpretation from the above findings and discussion is, since the cost side of airline operation is so extensive, that costs and expenses should have an impact on profit margin. Therefore, the way airline companies are able to exploit economies of scale and scope, could be a good way of measuring the cost effectiveness in relation to profit margin.

There are different variables that can generate scale effects for airlines. Hurdle et al (1989) find that economies of scale are very likely present as capacity changes depending on the aircraft size. This factor would depend on the way of measuring it, as larger planes are more expensive and so on, but capacity wise the scale effect is indisputable. One way of determining this scale effect would be to examine the proportion of capacity related costs to total operating cost. We expect the economies of scale and effectiveness to be significant for profit too, which will later be tested.

The huge investments combined with the large operating costs, make airlines in need of vast amounts of cash. The financing of airlines investments, and the foundation for operations, could come from either equity or debt. While debt is considered cheaper, it is, to a certain extent, also associated with higher capital risk. There is no clear optimal capital structure of airlines, but a higher degree of equity to assets is often associated with good economic condition for the companies. When conditions get difficult, firms easily turn to debt for fast cash. The equity to assets ratio is known as solidity, and as the name says; higher ratio makes a solid company. The solidity determines the degree of losses that can be taken by a firm before the creditors start making losses, and would have a direct impact on a firm's cost of capital (Leigh & Olverén, 2000). We consider this important as airlines are so cost intensive and thereby so is the cost of capital. Therefore, could a higher equity to asset ratio have a positive impact on profit margin in the airline industry?

1.2.2 The US market versus the EU market

As this paper intends to develop a model that captures variables affecting profit margin in US and EU, it is at this point important to stress that a direct comparison between the US and the European airline market is complex. Neither market can be fully replicated on the other, but the two markets have

many similar properties and are therefore interesting test objects. They have both a large and diverse transport industry. Both are developed regions, and driven by the market mechanism, i.e. competition, and market forces drive companies. Just as there are many similarities, there are of course a lot differences. The following part will clarify the relationship between the two markets.

The European Market

National rivalries within Europe had produced over 100 airline companies by the 1980s compared with approximately 30 airlines in the US. Fragmentation, excess capacity, and low productivity were accompanied by direct subsidies to loss-making state-owned carriers. To keep their national champions flying during economic downturns, governments took to heavily subsidizing their national carriers. These subsidies ranged from concerning specific routes, as well as entire companies (Yergin et al, 2000). National flag carriers is to some extent a European historical phenomenon, these carriers are viewed as an extension of national foreign policy and pride. The signalling effect of letting such a company go bankrupt is one of the underlying arguments of continuing to subsidize them.

A major step towards deregulation of the European aviation market came in 1985 when the European Court ruled that the EU Commission in Brussels had the authority to act on airfares. A shift was now created from a national aviation policy to the EU commission control. Three broad reform packages were adopted that gradually reduced the restrictions on intra-European competition (Yergin et al, 2000):

- *The first package*, adopted in 1987 and phased over three years, sought to reduce capacity restrictions, increase routes, and create zones with greater fare flexibility.
- *The second package*, adopted in 1990, built on the above reform sought to further increase market access and the right of European airlines to carry traffic between two other European countries as part of a flight originating in its home country. It also expanded the scope for fare discounting within certain geographic zones.

- *In the final package*, adopted in 1997, European carriers were granted full traffic rights within the European Union – including cabotage[4], meaning that airline companies now were entitled to operate domestic service in the other country.

The Organization for Economic Co-operation and Development (OECD, 1997) states that the above reforms have had a major impact on the competitive environment of European aviation. Although the EU Commission approved over $11 billion in subsidies to loss-making airlines between 1991 and 1997, the average yearly amount has since dropped by half and is likely to eventually be phased out.

The Swedish business paper Veckans Affärer (2002) states that the EU also controls ownership regulations as European airlines are blocked from acquiring more than 49% of another European airline. That is, if the home nation of the target airline has a bilateral agreement[5] with a non-EU state. If buying a foreign airline, the EU airline is then to adapt the national regulatory system of the target airline's home country. This meant that SAS could acquire the Norwegian airline Braathens, December 2001 (Dagens Näringsliv, 2001), without facing anything worse than the rage of the Norwegian Competition Authority, this is due to the fact that Braathens did not have any bilateral agreements with a non-EU state. The Norwegian Competition Authority (NCA, 2001) eventually accepted the acquisition but later prohibited earning bonus points on domestic routes (NCA, 2002) to encourage further competition.

The US Market

In the US, the situation is slightly different as compared to the European, as the market has been much more deregulated for a longer period. The deregulation process of the aviation industry began in 1979. Before 1979, the Civil Aeronautics Board controlled both the routes airlines flew and the ticket prices they charged, with the goal of serving the public interest. Along with

[4] Cabotage is the right to pick up traffic in a destination country and fly it to another destination in that country. The EU allows unrestricted airline operations only within the EU Single market and only by airlines qualified as community carriers.

[5] Bilateral agreement is when two countries enter into an agreement specifying how many routes they can fly between each other

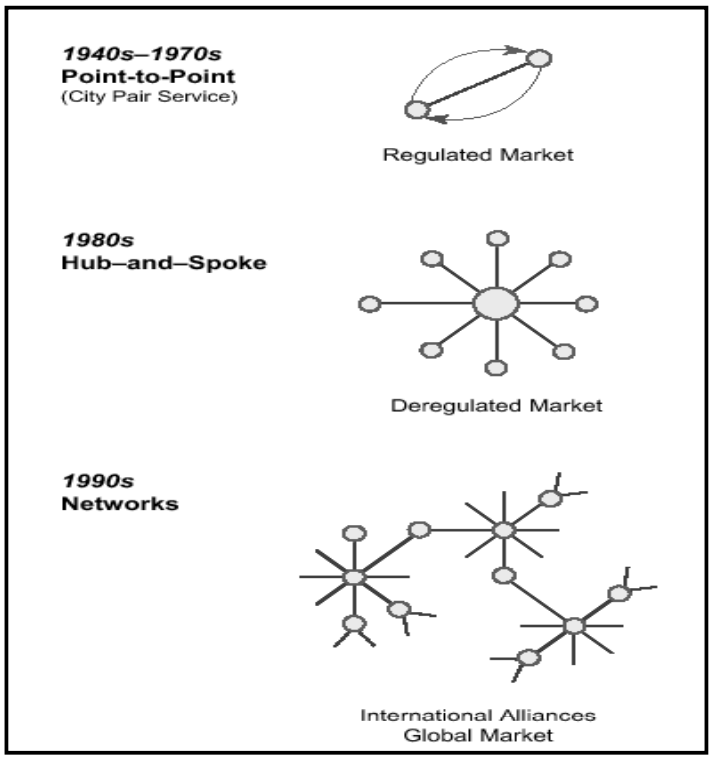
the deregulation, any domestically owned airline that was deemed "fit, willing, and able" by the Department of Transportation (DOT) could fly on any domestic route. The primary regulatory role of the DOT changed from approving whether an airline was operating in the public interest to deciding whether an airline was operating in accordance with safety standards and other operating procedures (Gowrisankaran, 2002).

Ownership and routes are liberated but local government still owns and manages the airports in their region, and therefore control key bottlenecks to airport services: access to boarding gates and runways. If this should be deregulated, the way to get access to the airport would probably be handled with a normal market mechanism, meaning some sort of bidding process. As it is today, the local government often requires proof that the airline would operate in the best interest of the public.

From Gowrisankaran (2002) further facts are stated:

- Since the deregulation in 1979 the U.S have experienced a 225% growth up until 2000, while Canada which deregulated its airline industry later, and has always had much less competition than the U.S, had a growth rate of 80% for the same period.
- Ticket prices have been decreasing by up to 59% in the U.S between 1979 and 2000, and in Canada by only 14%. Although average prices have fallen in the U.S, unrestricted fares often paid by business travellers have risen steadily.

Following the deregulation, many airlines start to operate on a “hub-and-spoke” system depicted in Figure 1.3. The hub-and-spoke system has allowed for efficient connections for passengers from small and mid sized cities, but it also has increased airline concentration at hubs. The net effect has been to increase the choice of carriers at non-hub cities and to increase the frequency of services but also to increase the concentration and congestions at hub cities.



Source: Fettered Flight: Globalisation and the Airline Industry, 2000

Figure 1.3 Evolving structure of the aviation market

It is still debated whether the airline industry need government intervention, since some of U.S biggest airlines have shut down or been acquired by other airlines, for example, Pan Am, Eastern, TWA and Texas air. The main reason for these incidents to occur is that profits in the airline industry can fluctuate widely. The reasons for these fluctuations are that an airline company's costs are largely driven by labour and fuel, and these costs are fixed in the short run, meaning a that a sudden drop in demand can have severe consequences.

Veckans Affärer (2002) points out that although the US aviation market is extensively deregulated internally, foreign owners are not allowed to own more than 25% of a US airline. The US Department of Transportation have raised the question of deregulating the ownership structure several times, but Pentagon has objected every time as American airlines are obligated to perform transportation services in a war situation. The Pentagon's reasons for this are that foreign airlines cannot be trusted in a war situation.

1.2.3 Market Review

In May 2001, the European Union had 14 big airlines and the US had six, which were about to consolidate into three or four (The Economist, 2001). The main reason for Europe having so many is the national ownership structure. Each country has practically its own "national champ" that shall survive on bilateral air-service agreements. Since these airlines are practically looked at as national symbols, they are to some extent protected against acquisitions and takeovers by national law and, to a certain extent, controversial subsidiaries. Bankruptcy is practically impossible. Even though Swissair went bankrupt in late 2001 a new national airline call Swiss, built on the foundation of Swissair, was instantly airborne.

Since the market conditions between EU and US up until 1997 were so different, these markets can be divided into two separate markets. Furthermore, since these two markets are differently regulated in time, they could be good test objects to see if the competitive environment in the US has a positive effect on the company profit compared to the EU market. There are complications to such a comparison, as both alliances and subsidiaries could "make noise" in the comparison. Alliances in the airline industry usually mean sharing of ticket sales and frequent flyer miles, and they are attractive for marketing reasons and for boosting revenues, which they do by 15-20% on average (The Economist, 2002). Although, according to a recent survey (The Economist, 2002), they disappoint in finding good ways to cut costs together other than sharing airport lounges and city-centre offices. It is therefore discussed if alliances really have any major impact on airline profits. Nevertheless, since most large airlines are in some kind of alliance anyway, the noise should not be too disturbing.

Different activities generate different yields, which also makes economies of scope interesting for airlines. This paper will examine passenger airlines, but not all airlines have a 100% share of passenger traffic. In addition to passengers and excess luggage, airlines could transport cargo. According to IATA (1984), cargo is considered a spin-off from supply of passengers. Hence, cargo could be seen as a way of exploiting economies of scope for airlines. Further, there are two types of passenger traffic, i.e. scheduled and

unscheduled (charter) traffic. US airlines have, as mentioned in Table 1.1, less competition from charter traffic than EU airlines. According to a study by Antoniou (1992), scheduled traffic also generates a higher yield than charter traffic. This should indicate a higher profit margin for airlines with a large amount of scheduled traffic among its services.

Table 1.1 Main differences between US and EU

United States	**Europe**
Consolidated	Fragmented
Larger airlines (Total passengers and employees)	Smaller airlines (Total passengers and employees)
Profitability key driver for route selection	Route selection has for a long time been driven for political and strategic reasons
Hardly no fast trains	Many fast trains on interurban transportation. Railroads are usually state owned with a politically powerful workforce. Therefore, airlines are not encouraged to compete.
No competition from charter operators	Competition from charter operators
Lower cost structure	Higher cost structure. Due to the fact that they are or until recently, state owned.
Unions less power	Unions' great power leading to more strikes.
Uniform infrastructure	Less uniform infrastructure
Standard air navigation system	Different equipment and operating standards among nations.

Source: Based on information from; Y. Aharoni, European Air Transportation: Integration, Globalisation and Structural Changes, 2002

In Table 1.1, the main differences between the two markets are highlighted. It can be read from the table that on average the EU airlines are smaller than the US counterparts. Further, Aharoni (2002) stresses that in theory, being small may be an incentive for a merger and the creation of a large-scale competitor. However, many EU airlines are not just smaller and less efficient. They are also more diverse in their culture. Most of the European aviation fleet started out as flag carriers and therefore might have more difficulties in restructuring than the US airlines. Most importantly, they are protected by the "substantial ownership and effective control" rules. From the above discussion and findings the belief is, everything else being equal, that deregulation could have a positive impact on profit margin; but is this the case in the airline industry?

Moreover, to strengthen the validity of our findings Winston (1998) further stresses the following results of deregulation in the airline industry:

- A change from point-to-point system to hub-and-spoke system emerged, meaning more frequent departure from smaller towns and cities.
- Increase activity of mergers & acquisitions
- Lower wages due to increased competition, resulting in weaker unions.
- Cheaper fares in the U.S with a reduction between 25-75% depending on the route, have been observed since deregulation.
- Cheaper fares have resulted in higher load factors.
- Innovations have spurred in both technologies, service and marketing.
- In a deregulated market airline companies prove to have a faster response-rate to external shocks, compared to a regulated market
- Deregulation often means initial high sunk cost, to grasp technologies that are more efficient.

Clifford also points out that deregulation is a long-term process. Big airline companies cannot change over night and their past behaviour is deeply rooted.

The 1990's were an eventful decade for the airline industry, with inconsistent market conditions over time. According to the ATA's annual review of the airline industry (ATA, 2002), the first two years of the nineties was a low-growth period. Losses were made and subsidies kept several airlines in the air. From 1993 however, the market changed resulting in a period of high growth, lasting for four to five years, turning losses into profit. During the mid-nineties passenger traffic was accelerating, decreasing frequency of delays, and increased fuel efficiency. The last three years was again a low-growth period and profits were made on average. However, they were stabilizing and later falling.

1.2.4 Profit and Performance

Profit margin is a well-known and respected measure of a firm's performance. Profit margin clarifies the relationship between total sales and the earnings these sales provide, as this percentage measure indicates the real margin the

firm has on its operations. Further, as Schranz (1993) points out, shareholders are the residual claimants of the firms profit; profit margin therefore becomes a significant decision factor when investing. There have been studies performed on variables affecting profitability, also in the airline industry (Doganis, 1991; Antoniou, 1992; Schefczyk, 1993). However, these studies were conducted in the early nineties and do not seem to investigate the effects after the final EU deregulation process in the airline industry ending in 1997. The US airline industry is many years ahead of the European regarding the process of deregulation. According to calculations made by Morrison and Winston (1995), airline profits in the US have been greater with deregulation than they would have been if the industry had still been regulated. Fares would have been higher, but higher wages and less efficient operations would have more than offset those gains for the airlines.

We would assume that deregulation should provide opportunities to expand, develop and broaden an airlines horizon, but this could be just a little too obvious. On the contrary, the established EU airlines might not have been properly prepared for the changes and the possibilities emerging in the industry. The magnitude of changes like this takes time to grasp and the possible opportunities might lie years ahead.

1.2.5 Hypothesis

We have during this problem discussion presented quite a few questions and arguments regarding performance in the airline industry. For the coming research we will now clarify four hypotheses based on the previous questions and arguments, which could affect profitability among airlines, and will later be tested in the analysis.

i) Economies of scale could be present in the airline industry

ii) Equity financing could have a positive effect on profitability

iii) Market deregulation could have a positive effect on profitability

iv) Economies of scope could be present in the airline industry

The first hypothesis (i) relates to the cost side of airlines and the huge operating costs, hence, we expect economies scale regarding size (Caves et al, 1984), labour productivity, and the vast capacity related costs experienced by airlines (also argued by Antoniou, 1992). The second hypothesis (ii) derives from the investments and financing aspect, where equity financing should have a positive effect on profitability (Leigh & Olverén, 2000). The third hypothesis (iii) is market deregulation, hence, a higher performance and profitability among US airlines compared to their EU counterparts (summarized in Table 1.1). The fourth hypothesis (iv) is that there are economies of scope in the airline industry, especially regarding cargo traffic (Doganis, 1991 and IATA, 1984), and the share of scheduled traffic (Antoniou, 1992).

1.3 Purpose

Based upon the problem discussion, the purpose of this study is to identify variables affecting firm profitability in the US and EU airline industry, with respect to economies of scale/scope, capital structure and market differences. Further, we aim to investigate if these variables act differently in the US opposed to EU, due to differences in regulatory settings.

1.4 Potential Contribution of the Study

To our knowledge no previous quantitative study of this kind has been undertaken before. Several studies have been performed on the US deregulation process in the airline industry (Button and Keeler, 1993; Bailey, 1986; Baily, 1993; Kahn, 1988), although, we were not able to find any study that compared the two markets (US & EU) in a quantitative manner. Doganis (1993) looks at the cost structure of airlines and its impact on profitability, Antoniou (1992) examines different variables affecting airline profitability, although, he does not separate any markets. Schefczyk (1993) conducts an efficiency study on the airline industry. Rundqvist and Schön (1998) carried out a study comparing the regulatory environment between the US and

Europe airline industry. These studies are all mostly based on qualitative data or efficiency studies, and we have not found any study similar to our purpose and problem definition relating to the airline industry. The potential contribution of this study is therefore to create a clearer view of the impacts and importance of further market deregulation and liberal competition of the European airline industry.

1.5 Assumptions & Limitations

The thesis has several limitations that should be taken into account when assessing the relevance of the results. This is not to say that the result and conclusion are less valid and relevant but rather that the following facts have been kept aside. It would not have been feasible to focus on our purpose and conduct a valid analysis if all dissimilarities between EU and the US must be taken into consideration. It simply became too great a task. The importance and impacts of variables unaccounted for in the analysis will always be a possible error-term. We have summarized some of the main differences between the two markets, possibly affecting performance, which we were not able to identify through the data available. The effects of the following assumptions and limitations on airlines profitability is therefore an open question.

- Subsidizing. Subsidizing airline companies is an activity that has been heavily practiced on both sides of the Atlantic Ocean although to a much greater extent in Europe than in the US. The financial data used for our analysis does not provide us with this information and therefore any possible effect of this activity on airline profit margin cannot be tested.
- Low-cost airlines. After the full deregulation in Europe in 1997, many newcomers known today as low-cost airlines started to emerge. This business model has been conducted in the US since they deregulated their market, many with great success. Since 1997 many entrepreneurs and European airlines have tried to duplicate this model into the European market. We have not been able to separate these low-cost airlines in the analysis.

- Alliances. Alliances are a widely discussed topic nowadays. In this report we have not taken this into consideration in our model, this is due to the fact that the spectra of our financial data ranges over a nine-year period. Alliances have come and gone and so have different airline companies. There was no data available when the airlines entered or left the different alliances so we decided to overlook this variable affecting firm profitability.
- Off balance sheet financing. Off balance sheet financing (leasing, factoring and so forth) have not been included in the data and the effect on profitability has not been analysed. According to Schefczyk (1993) most airlines lease a substantial fraction of their aircraft. This type of financing was not present in the financial data and was neither possible to obtain for all the airlines in the estimated period.
- Political environment. Political differences between the two continents have resulted in different development and evolution of the aviation industry in the two markets. For example, route selection has for a long period in Europe been driven for political and strategic reasons, not purely for profit as the route selection in the US have to a greater extent been. Political differences have been limited to the European Union contra the United States, and also the basis for stronger labour unions and so forth.
- Standardization. Moreover, US have a well functioning standardized air navigation system that covers the whole country. This is not the case in Europe as each nation has for a long time operated isolated from other nations, resulting in all nations operating their own air navigation system. Any economic effects this standardization has cannot be tested through the information available.

2. Data & Methodology

In this part of the paper, we will provide the methods of how we collected, structured and analysed the data. In this section we seek to describe as clearly as possible what has been done in practical terms. In principle, we will highlight the investigation process, sample size, details of the techniques used, and other specific factors that affected the work. In order to investigate and analyse the outcome of the main purpose, we added four hypotheses. These hypotheses create the basis for further data-collection and theories, followed by a quantitative research model, the analysis and interpretation. We have designed a research model (Figure 2.1) where the sequential process of the research is defined.

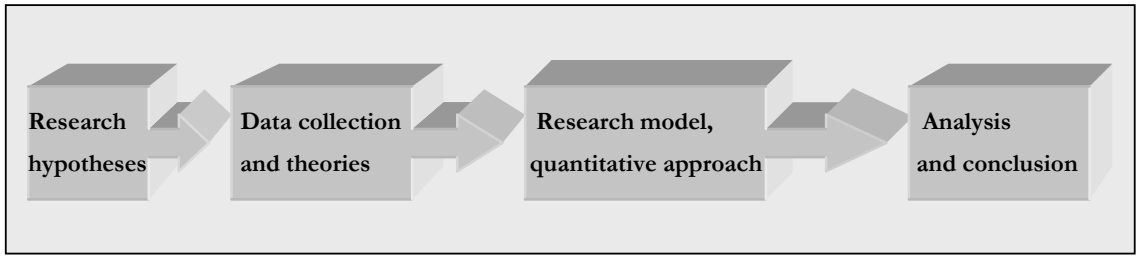


Figure 2.1 Research model

2.1 Research Strategy

The airline industry is interesting for its historical, present, and future position on the world business arena, as it has been a key-factor for globalisation and world trade. After a vast background study within the industry, many ideas and thoughts emerged regarding airlines and performance. Tourism and travelling is rapidly growing and markets are expanding, nevertheless airlines do not seem to be more profitable. This led us to the problem discussion. Finally, the purpose of this study was defined.

As the purpose was defined according to the academic standards at the Graduate Business School of Gothenburg University, the next issue is how such a problem should be investigated further. Search engines as “jstor” (which searches through a number of scientific journals), Google.com, and the economic library’s own search engine for e-journals and literature,

provided the foundation for the research structure. We searched for similar problems and studies made on other industries, in order to create a credible theoretical background for the model and the data collection process.

Two Research Models

According to Johns & Lee-Ross (1998), there are essentially two research models to choose from when conducting a research study i.e. the *inductive* and *hypothetico-deductive* processes. Inductive reasoning involves drawing hypotheses from observations by a process of analysis. The model of science is called inductive reasoning because the observations are supposed to lead naturally to the hypothesis. Hypothetico-deductive, on the other hand, involves proposing an initial theory (a rigorously defined hypothesis) which can then be confirmed or refuted by experiment. According to this latter model, the anecdote provokes the researcher to put forward a hypothesis, which then will be tested by experiment to see whether it is supported by practical experience.

Two Research Methods

According to Lekvall & Wahlbin (1993), there are two main research methods available: a quantitative method and a qualitative method. A quantitative study implies that numerical data is collected and analysed with the help of statistical methods and tables. A qualitative method on the other hand implies that one examines just a few, or a single object, but where the data collected cannot be expressed in numerical terms. Which method can be considered most appropriate varies depending on the research question as well as the data available. To fulfil the aim of our purpose and test the hypothesis, a large amount of numerical data is needed to conduct a statistical analysis; hence, a quantitative approach is used for the main analysis. Although most variables will be based on financial raw data, some of the variables within the regression equations might be evaluated by a qualitative approach, i.e. dummy variables.

2.2 Our Research Model

In order to achieve our purpose, to identify variables affecting firm profitability, with respect to economies of scale/scope, capital structure and market differences the problem discussion supported by the theoretical framework, lies the foundation for the empirical study of this paper. We identify hypotheses, which then further will be examined in our model. Therefore, the hypothetico-deductive model is the method for our analysis. The method used for this paper is quantitative by nature, as we are investigating financial raw data from the airline industry. Further, to accomplish our purpose we had to process this raw data into measurable numbers and key ratios. Finally, to make sense for the reader and us, the measurable numbers and key ratios were run through a multiple regression.

Multiple Regression
Multiple regressions, also known as ordinary least squares (OLS), seek to model data into a relationship between one dependent variable and several independent variables. Unlike simple linear regression, it allows more than one independent variable to be considered. Our variables, dependent and independent, will illustrate the various categories named in the purpose, i.e. economies of scale/scope, capital structure and market differences. The process of selection for the different variables is one of the crucial parts of regression analysis. To capture the essence of these categories requires a great amount of research.

The formula for the multiple regression equation is:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_1 x_3, etc.$$

where y is the dependent variable and x_1, x_2, x_3, etc. are the independent variables. β_0 is the value of y when all independent variables are zero and β_1, β_2, β_3, etc. are the coefficients which relate the independent variables to the dependent variable (Johns and Ross, 1998).

2.3 Research Categories

When implementing a statistical model on firm performance there is numerous amounts of possible variables. Based on the hypothesis in Chapter 1, we have identified four distinct categories of variables:

1) Economies of scope
2) Economies of scale
3) Capital structure
4) Market regulation.

Based on a similar study by Antoniou (1992), we believe these categories will capture most of the operational differences for airlines, even though the four categories will only consist of a few variables in total. We choose to limit the amount of variables, as the data available for each analytical period is relatively small[6]. The decision of variables in relation to categories is based on traditional economic theory, concerning both company fundamentals and market conditions. This is done to increase the validity and produce a rational foundation for the analysis and expected outcome. The analysis will also be done for several years (1993-1999), increasing the reliability of the produced results.

Economies of Scope

Economies of scope will be referred to as scope activities, i.e. activities produced only because another one exists. The core activity of the airlines in this analysis is passenger traffic. We have identified two variables to cover the area of scope activities for airlines; share of scheduled versus unscheduled traffic, and share of passenger versus freight. It is argued that unscheduled traffic and freight activities are additional operations for passenger traffic airlines. An airline can surely be specialized in charter (unscheduled) traffic, but as will be discussed later, the payoff is expected to be considerably lower.

Economies of Scale

Economies of scale, which is later referred to as scale opportunities, is meant to determine the scale advantages that might occur for airlines. Under this

[6] The data for US and EU is limited to approximately 50 airlines in total for each year.

category, there are three variables; Size, labour productivity, and capacity related costs. The ultimate measure of scale would be size, and if magnitude improves performance. Productivity and cost effectiveness is also interesting considering scale, hence labour productivity and the share of capacity related costs are meant to capture possible advantages relating to economies of scale. Economies of scale/scope will be further explained in the theoretical framework

Capital Structure

Capital structure refers to the capital risk of the company, i.e. equity over asset. This ratio, known as solidity, indicates the riskiness of the company's financial position. For this measurement, we have one variable. European companies are on average financed differently compared to U.S airlines. The U.S airlines have relatively more equity than their counterparts do and we will investigate if this relationship has any effect on performance. Capital structure will also be further examined in the theoretical framework.

Market Regulation

Depending on where an airline operates, differences in restrictions and market conditions occur. As argued in the introduction the US deregulated their market earlier than the EU market, resulting in a more liberal and competitive market than the EU up until the final deregulation act in 1997. The effect of this relationship will be investigated; hence, there could be different variables.

2.4 Data

The data used for perusing this analysis is provided by ICAO[7] (International Civil Aviation Organisation) for the Gothenburg School of Economics and Commercial Law. It contains detailed accounting data on the income statement and the balance sheet, including tonne-kilometres available and performed. The data set contains information on airlines from a variety of nations, where we sorted out the ones with EU and US origin. We also

[7] The aims and objectives of ICAO are to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport. For further reading we suggest ICAO's homepage, www.ICAO.org.

eliminated the cargo airlines, i.e. an airline whose main activity is freight, not passenger traffic, as passenger airlines is the purpose for testing in this paper. Some airlines were also eliminated, as there was missing data on one or more variables. Initially there was data from 1991 until 1999, but unfortunately 1991 and 1992 did not contain enough data to be included in the regression equation.

Compiling the Data

The data was initially sorted after the airlines national origin, hence, there was no problem separating the different continents. We are aware that we have a smaller amount of data on the US airline industry, but as there are also are fewer airlines operating within this region, such a consequence was quite natural. The selection process left us with 264 observations, where 110 were from the US and 154 were EU airlines. The data ranges from 1993 until 1999.

All of the data variables available for us are left to Appendices 1 and 2, but the data used in this analysis are listed below:

- Operating revenue
- Capacity Related Costs:
  - Flight operations (total)
  - *Maintenance and overhaul*
  - *Depreciation and amortization (total)*
  - *User charges and station expenses (total)*
- Total operating expenses
- Operating result
- Equity
  - Unearned transportation revenues
  - Advances from affiliated companies
  - Capital stock
  - Capital surplus
- Total liabilities
- Scheduled passenger traffic (T-km performed)
- Total scheduled traffic (T-km performed)
- Total T-km performed
- Total T-km available
- Number of employees

The data is selected based on the four categories and the variables identified within each category. The variables will be presented in detail in Chapter 3,

but the validity of the data provided is definitely a matter for discussion. When combining different countries in the same analysis and using accounting data, the matter of accounting rules and their effect is always a possible error term. According to Bernstein (1993), there are several limitations to accounting data worth mentioning for this thesis. For example, the financial statements contain very little direct information about the character, motivation, experience, or age of the human resources. They do not contain information about the quality of the research and development. Nor can we expect to find any detailed information on product lines, machinery efficiency, or advance planning. Finally, cost balances do not; in most cases represent current market values. For example, according to Rice (1997) the accounting value of a plant (historical cost less accumulated accounting depreciation) does not necessarily indicate the market or selling value, which is what the manager wants to know when considering shutting down or keeping the plant open.

We seek data for the variables before interest and taxes, i.e. operating result. Further, when calculating the equity, we eliminate each years retained earnings and changes in reserves, so each year's equity will not be affected be the earnings or losses from that year.

Missing values
There was a hitch concerning the airlines accessible for each year, as the various airlines were not present in every year. This means that we can't follow the individual evolution of each company, but have to test a larger set of dissimilar observations within each test. If we had only included the airlines available for every year, the total amount of data would be very small. It was therefore necessary to group the data together, known as pooling. This type of data also goes under the econometric category of cross-sectional data.

2.5 Interpretation and Conclusion

The aim of the following analysis is not to create a model that explains all variations in profit margin for airlines (if we get a significant result, that is), but rather to test if the hypotheses are true and if the European airlines

perform worse than their US counterparts in various parts of the microeconomic environment. We would like to test if the variables in our model, affect firm performance, and the ability to market adaptation. This means the R-square in the regression output (the output which indicates the explanatory value of the model) is not the most central output, rather to test if, and with what significance, the variables chosen alter firm performance (in other words, significantly different from zero).

3. Conceptual Framework

3.1 The Variables

This part of the thesis intends to explain the concept and the background of the chosen variables for the model. Theoretical relations will be described, although the actual theories will be presented later in the theoretical framework.

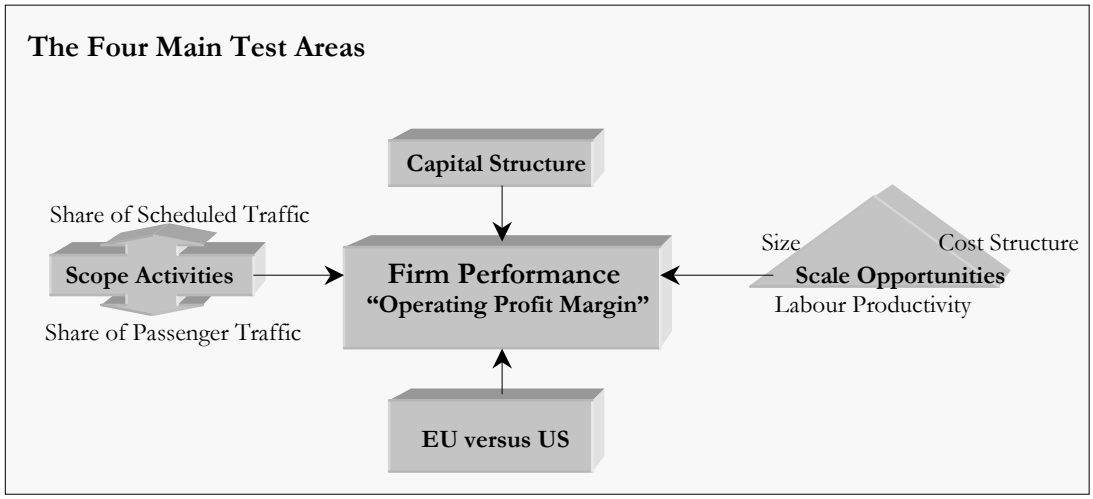


Figure 3.1 The four categories and the variables

3.1.1 The Dependent Variable

Operating Profit Margin

When considering firm performance there are several variables to evaluate. In this kind of analysis the relation between revenue and costs are natural. Firm performance, observed by an outside investor, is generally the profitability of the firm. In addition, as argued by Schranz (1993), the shareholders are the residual claimants of the firm's profit. Indeed, another study in this area, Antoniou (1992), considers the operating profit margin (OPRM) as the less flawed measure of profitability. Focusing on operating profits (rather than net profits or revenue) allows for cross-sectional comparisons between airlines from different countries, following different accounting and taxation policies. These different policies are subject to different tax and subsidy regimes, with different capital gains and losses and different foreign exchange operations.

3.1.2 The Independent Variables

Share of Scheduled Traffic

Scheduled traffic is here an output measure of a firm's activities, where non-scheduled traffic is the portion of charter passenger services. Several observers, such as Antoniou (1992) and IATA (1984), show that there is a positive effect of an increased scheduled component on profitability. It is argued that airlines tend to "overcharge" their full-fare passengers in order to make up for the loss on their charter-competitive fares. Even though there might not always be losses, the profit generated is limited. Charter traffic might be considered an effect from economies of scope, from the potential contribution to cover aircraft costs. Owning aircrafts is very cost demanding and charter traffic can be considered as a surplus activity reducing fixed costs, but with an unfortunate side effect that it fades-out some of the profit margin.

Share of Passenger Traffic

Share of passenger traffic (as opposed to freight) in total traffic is introduced as yet another output measure of activities. An earlier study by Doganis (1991) documents that passenger traffic generates a much higher yield per ton-km than those generated by freight, consequently suggesting a positive effect from this variable. On the other hand, a more cautious reasoning would lead to the opposite conclusion, as most airlines see freight and cargo as a by-product arising from the supply of passenger service (IATA, 1984). The arguments is that the more freight, the more the airline exploits its excess capacity, and the surplus revenue is considered a contribution towards passenger cost service. This surplus produced can also be explained by the theory concerning economies of scope. Therefore, in relation to passenger load factor, the expectation is a negative effect from this variable on profitability.

Size

Since size can provide economies of scale and in some cases diseconomies of scale, it is likely to affect the profit of a firm. Research by Caves et al (1984), found there were no significant economies of scale between large airlines, and that the vast increase in smaller, profitable airline companies proved little or no scale effects regardless of size. Since there is no indication of

diseconomies of scale for airlines, we expect this variable to be positive or insignificant on profitability, as larger companies seems to have a larger survival potential (diversification possibility) during tough economic conditions.

Labour Productivity

Productiveness of employees is a very important measurement of effectiveness, hence economies of scale. Airlines need both flight and ground personnel to operate, a separation between the two groups could have been possible. However, separating these two groups for this analysis makes little sense, as we are interested in total productivity, meaning that the whole value chain is measured. Both flight and ground personnel are needed to make ton-km available. This productivity measure is clearly an indication of potential economies of scale emerging in the airline industry. Labour productivity is therefore evidently expected to have a positive effect on profitability.

Cost Structure

An equally important measure of productivity would be to examine the cost side. We examine costs related to capacity, meaning the flight or aircraft costs. The remaining are passenger traffic-related, i.e. passenger services, ticketing/sales/promotion, and other administrative costs. For a given load factor this variable should be negatively related to profitability, and negatively correlated with labour productivity. This is also expected to come from scale possibilities in the industry; consequently, the relative costs will be reduced as the amount of output increases.

Solidity

The financing structure is included in our model to investigate the debt structure of airlines. Debt generates interest payments, which can be a significant cash-outlay. Equity in contrast does not require these payments, although the firm would expect shareholders to request some return on investments. We would expect that a higher degree of equity financing relative to debt would have a positive effect on profitability.

Deregulation

Operating under different market regulations is expected to influence the firm performance. The two markets (US vs. EU) chosen for this analysis are characterized by different market conditions, as the US market is more liberal concerning competition and other regulatory settings. Accordingly, the theory of perfect competition appears logical. Although such a theory might seem a little extreme, earlier problem discussion and the coming theoretical framework, will further describe and clarify this relationship. The EU market, in contrast is much more restricted, thus, monopoly and oligopoly theory will fit this market better. In this market, national routes are often operated by few airlines, giving a very quick response rate to a competitor's action. This can be explained by the oligopolistic interdependence (Reekie et al, 1995). Despite this internal competition, the market is often separated between these airlines giving each their own market, within the market. Because of this internal market segregation, a monopolistic pricing strategy might evolve.

Even though market theories on monopoly (Suneja, 2002) suggest a higher profit margin for EU airlines, due to the fact that this market has more of the monopoly characteristics, the hypotheses in this paper turn the whole situation around. We predict that the deregulated market environment, the drive for costs cutting measures and the incentive to earn excess profits in the US (Winston, 1998), gives the US airlines a potentially higher relative profit than its EU counterparts do. As a result, this dummy-variable should have a positive effect on profitability, US equals 1 in the dummy variable.

The Period

An eighth and final variable, not directly related to operations, is the period. The period is divided into years, and is added to capture any periodical changes. These changes are important from a statistical aspect to capture trends in the dependent variable, but years could also indicate a general market increase during one of the periods. The direction of this variable is therefore insecure, all depending if the market trends go up or down.

Table 3.1 Summary of the variables

Category	Definition	Measurement	Sign
Dependent	PMARGIN = profit margin	$\frac{Total\ Operating\ Profit}{Total\ Operating\ Revenue} * 100$	
Scope Activities	SHSCH = Share of Scheduled Traffic	$\frac{Scheduled\ \ T-km\ Performed}{Total\ ton-km\ Performed} * 100$	+
Scope Activities	SHPAS = Share of Passenger Traffic	$\frac{Passenger\ \ T-km\ Performed}{Total\ ton-km\ Performed} * 100$	—
Scale Effects	SIZE = Scale effects	Dollar value of assets	+
Scale Effects	LAPRO = Labour Productivity	$\frac{Total\ \ T-km\ \ Available}{Number\ \ of\ \ Employees}$	+
Scale Effects	COST = Cost Structure	$\frac{Capacity\ Related\ Costs}{Total\ Operating\ Costs} * 100$	—
Capital Structure	SOLID = Equity Financing Ratio	$\frac{Equity}{Total\ Assets} * 100$	+
Deregulation	DEREG = US versus EU	Dummy variable where 1 indicates US and 0 is Europe	+
The Period	Year	Indication of the years in the different periods	+/-

3.2 Statistical Equations

Figure 3.1 illustrates the four categories (eight variables) to be tested against profitability, and Table 3.1 summarizes the variables and the expected outcome and impact. Since changes are expected to happen in 1997 due to the deregulation in the EU, we divide the data into two periods, i.e. before and after 1997. The first period ranges from 1993 until 1996, as we had to eliminate 1991 and 1992 because of missing information. The second period ranges from 1997 until 1999. Two changes happen around 1997, that is the third and final deregulation package in the EU, but also a general low-growth period starts in the late nineties (ATA, 2002).

The Equations

The different equations come naturally from the conceptual framework, and all variables are included for every year. As we have a relatively small amount of variables, we do not consider this a problem.

For the test on the US airlines:

$$PMARGIN = \beta_1 SIZE) + \beta_2(LAPRO) - \beta_3(COST) + \beta_4(SHSCH) - \beta_5(SHPAS) + \beta_6(SOLID) + \beta_7(YEAR) + e_1$$

For the test on the EU airlines:

$$PMARGIN = \beta_1 SIZE) + \beta_2(LAPRO) - \beta_3(COST) + \beta_4(SHSCH) - \beta_5(SHPAS) + \beta_6(SOLID) + \beta_7(YEAR) + e_1$$

For both US and EU together when comparing profitability:

$$PMARGIN = \beta_1(DEREG) + e_1$$

For practical reasons we added year as a variable when running the entire periods, for no other reason than to be aware of a possible increasing or decreasing effect over time. This is not very important for the analysis itself, but more from a validity point of view, i.e. trends in variables may cause interferences[8] in an OLS analysis, and countermeasures must be initiated.

[8] Such interferences may be heteroskedasticity and/or autocorrelation.

Two Periods

To summarize the expected outcome before the final analysis, we would like to describe the periods one last time. Initially we described the globalisation process, of accelerating integration and combined national economies. It's possible with different growth periods in the US and EU, but over time, highly unlikely as the airline industry is one of the most global industries. Therefore, the outcome from the different periods is expected to have the same direction for both the US and EU. According to ATA (2002), the period from 1993-1996 is characterized by high growth for both continents and regulations regarding traffic and airports in the EU. The period from 1997-1999 is a low-growth period combined with the launch of the third deregulation act in the EU, liberalizing the competitive environment. The impacts from the variables in the equations are not expected to change in direction, but only increase in strength for the later period.

4. Theoretical Framework

This part of the thesis intends to clarify the theories employed to identify the variables affecting firm profits. They will be described by their basic content and assumptions, and in what way they can be utilized to clarify the airline industry. Perfect competition, oligopolistic interdependence and monopoly pricing will be explained, followed by economies of scale and scope. Furthermore, theory on solidity (capital structure) is also accounted for.

The Business Environment

The business environment in which the airlines operate is in many ways very complex. It therefore becomes hard to pinpoint in which type of business environment they exist, perfect competition, oligopoly or monopoly. However, as we are focusing on two different markets for this thesis one interesting thing must be to separate these markets in some sort of way. Perfect competition, oligopolistic interdependence and monopoly cannot be applicable perfectly to either of the markets. One reason for this strange business environment is due to the fact that the airline industry has historically been regulated in both the US and in Europe since the start of the aviation industry. This has affected the business environment in many ways and in most of their characteristics. One can say that regulations impose some sort of monopoly situation in the means of decreased flexibility and less credit for innovation. The eagerness to become cost conscious and efficient becomes less vital in this case.

Further, as discussed in the problem discussion, companies operating in a regulated market environment become less innovative and lose flexibility, which in turn leads to slow response to internal and external shocks. However, gradually the monopoly situation in the airline industry have been relaxed in an attempt to increase competition and to make it affordable for a larger set of people to fly. This has led to a more oligopolistic like environment where few players controlled the market and controlled the fare price they charged. If one airline company tried to cut prices or in any other way tried to differentiate itself from the rest of the players, an immediate response from the others was expected. So how does the market look today? Well, progressively the business environment is becoming more and more

liberal, leading to increased competition and more players entering the market. According to the Economist (2002) low-cost airlines have entered the market and put pressure on the mainstream airlines in both the US and EU. One can say that in an regulated market many of the monopoly characteristics are present while on the other hand in an deregulated environment many of the perfect competition features exists. In between these two extremes oligopolistic like behaviour can be observed. In the US there was a clear cut from regulation to deregulation, that is to say that the companies were thrown from a comfortable seat prior to 1979, to a much more vulnerable seat when the deregulated market were implemented.

In Europe the situation has been a bit different as the deregulation process has been conducted gradually over a twelve-year period, resulting in oligopolistic behaviour between the time of a fully regulated market and today. Today Europe is closer to the US regarding the business environment, as the third and final deregulation act was implemented in 1997. As discussed in the problem discussion we also believe that economies of scale and scope characteristics to be present for many airlines and a natural development deriving from increased competition. When competition increases and airlines companies grow they should be able to grasp these benefits. Further, as mentioned in the problem discussion Hurdle et al (1989) find that economies of scale are very likely present as capacity changes depending on the aircraft size. Finally we intend to measure if capital structure has any significance on profit margin, we will use solidity as our ratio for measuring if this relationship exists.

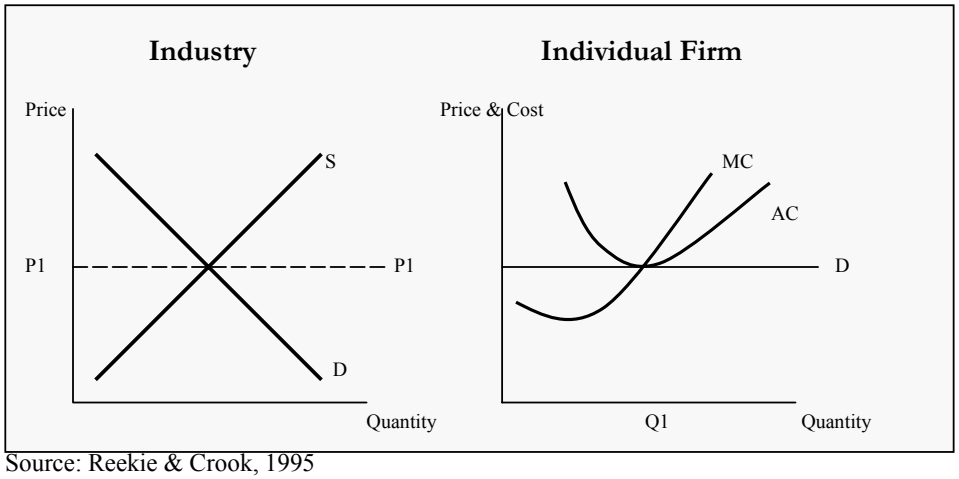
4.1 Perfect Competition

A market where perfect competition exists has some well-known characteristics, such as large number of buyers and sellers, none of who is powerful enough to make a transaction that affects the going market price. The economic theory of perfect competitive markets requires that the product should be homogeneous, as we previously argued to be the case for airlines, and that there would be low barrier for new suppliers to enter and operate without price or capacity controls. According to The Economist (Oct. 2002)

both the US and EU airline industry (after 1997 for the EU) have succeeded by allowing smaller-scale operations that arbitrage the cost distortions of the larger "sovereign" carriers.

The theory also requires that the consumer should be fully aware of the prices being offered by the different suppliers. The new low-cost rivals have all implemented a modern IT-platform to handle the customers booking activity, this with the attempt to get rid of the middle men, the travel agency. Further, in an attempt to keep the administrative cost as low as possible. This business model will allow the active customer to be almost fully aware of the ticket price offered by the different airline companies. Today, these new entrants have shaken the competitive environment in the airline industry. Even so, according to (The Economist, 2002) traditional carriers remain essentially in a different business from their low-cost rivals, because their networks are more complex. And they have all the historical baggage of unions, entrenched working practices and so on. So it is very difficult for a network carrier to reinvent itself as a low-cost carrier.

Under perfect competition, firms will accept the going market price; hence, firms will be price takers, not price makers. Firms will then settle on the production quantity that will maximize their individual profit levels. This is further illustrated in Figure 4.2 below, where price will be determined by the industry's supply and demand curves, S and D. The individual firm, which faces the horizontal demand curve, will accept price P_1 and set its production to Q_1, where price equals marginal cost.



Source: Reekie & Crook, 1995

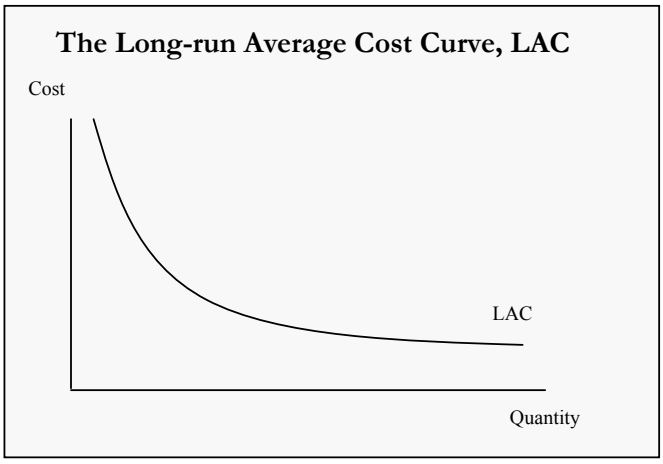
Figure 4.1 Perfect competition

If the minimum point of the average cost curve (AC) lay below the horizontal demand curve, abnormal profits would have been earned. This would again tempt new entrants into the industry and the supply curve (S) would have fallen downwards until equilibrium was reached, and abnormal profits could no longer be earned.

Perfect competition is rarely seen in reality, and this market scenario is not a perfect description of the US airline industry, because there are too many "unrealistic" and strict assumptions. The immense competition in the existing US airline market generates a continuous drive for cost cutting measures and for product differentiation, consequently creating opportunities to make excess profits. Theory also claims the possibility of earning excess profits is non-existent over time (Reekie et al, 1995).

4.1.1 Economies of Scale

Economies of scale are a phenomenon deriving from increased competition and globalisation. The common theory of cost anticipates that the long-run average cost curve is declining as output is increased because of the occurrence of economies of scale (Brealey et al, 2001). There are two different ways scale-effects can occur, namely real or economic. Real economies of scale take place when, due to technological availabilities during the output process, the average input per unit output measured in average costs declines. The theory of costs is derived from the long-run average cost curve (see Figure 4.1) under the assumption that prices are constant. However, in practice there could be economic scale-effects, such as lower input prices for bulk purchases. Including such phenomena in theory would complicate matters a bit, but eventually contribute to an even steeper sloped long-run average cost curve.



Source: Reekie & Crook, 1995

Figure 4.2 Economies of scale

Diseconomies of scale are an opposite phenomenon that can occur. Common cost theory predicts that the long-run average cost curve will turn upwards, after a certain output, because of diseconomies of scale. This inefficiency can arise due to large plant size etc, but are usually associated with managerial problems and labour relations. If diseconomies of scale should occur in airlines, management and labour would be the likely cause. However, we do predict economies of scale to be present rather than diseconomies, as larger airlines means less power to unions and diversification on routes and markets. Caves et al (1984) argue that larger airlines have a cost advantage over smaller ones.

4.1.2 Economies of Scope

Economies of scope are another interesting theory for airlines. Scope-effects occur if a firm is capable of sharing at least one input between products. If total costs of producing these products together are lower than they would have been producing them separately, economies of scope exist (Reekie et al, 1995). Sources for economies of scope can be spare capacity, multi-use facilities and so forth. Such arguments are very interesting for airlines since, as argued earlier, most airlines see freight/cargo as a spin-off effect from access capacity in the aircraft (IATA, 1984). Hence, the amount of freight of an airline's T-km performed, would indicate the scope effects present and

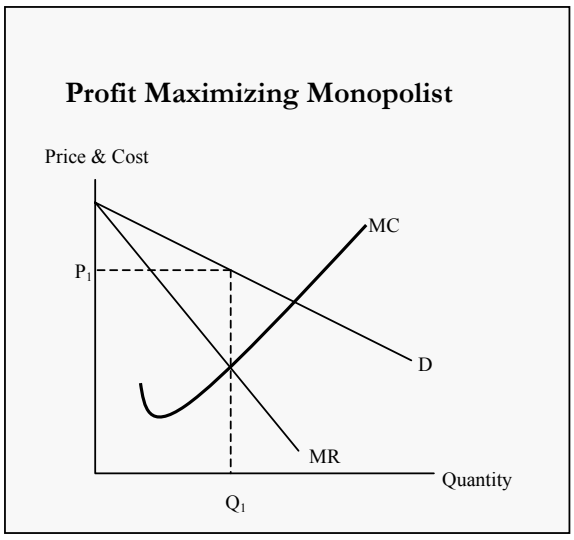
taken advantage of for the different airlines. Another interesting scope-generating variable is scheduled traffic versus charter traffic. According to Antoniou (1992) scheduled traffic is supposed to generate higher profit per T-km, but since additional charter traffic may reduce hours that the aircraft is standing on the ground, they help to reduce some direct costs. This behaviour may well be good for the airline even though it reduced the profit margin per T-km produced.

4.2 Oligopolistic Interdependence

Oligopoly explains more of the EU competitive environment, as this economic environment is categorized by a few large firms competing against one another (mostly within the different nations). These few firms' behaviour is explained by interdependence, which means that any decision one firm makes, concerning price, product or promotion, will change the business behaviour of competitors resulting in counter-moves, in an attempt to not lag behind. As a result, the competitor's behaviour is largely explained by the firm's own behaviour, and must therefore be taken into account when decisions are made. The interdependence makes predictions of changes and optimal decision-making difficult. Price leadership and non-price competition are methods used to remove or limit the uncertainties of interdependence which envelops the decision making process. Unfortunately, such market conditions could also lead to cartels, and price cooperation, which are mostly illegal for competitive and consumer purposes.

4.2.1 Monopolistic Pricing

Pure monopoly is just as rare as perfect competition, and the EU airlines operate in neither a perfect monopoly situation nor a perfect competition situation. However, the EU market carries some of the same properties as one can find within monopoly pricing. In a monopoly situation, the marginal revenue and the marginal cost, creates the equilibrium and determines the price taken and the quantity produced (Figure 4.3), assuming profit maximization.



Source: Reekie & Crook, 1995

Figure 4.3 Monopolistic pricing

A monopolistic price policy could attract potential entrants as the price generates significant excess profits. As a result, the monopolist can lower its prices and by so doing force the competitor into a price-cutting competition (Call & Holahan, 1983). Therefore, new entrants will presumably not be interested in entering the market and the monopoly situation remains, thus with substantially lower profit. The firm has then chosen to operate alone with a lower, but secure and low-risk profit margin.

4.2.2 Pricing Strategy in Perspective

To summarise the above theoretical standpoint, it should be possible for an airline company operating in a monopolistic or oligopolistic competitive environment to have a higher profit margin. This is not to say that neither the U.S nor the European is operating in any of the above mentioned extremes. However, when comparing the two markets there is clear evidence that the U.S airlines are operating in an environment nearer to a more competitive environment than the European airlines. So in theory the European airlines should be more profitable. Moreover, the fact that EU-nations are using the airlines as a national symbol is no news, but whether it is the most profitable ownership structure is not obvious at all. Decisions might be based on securing national interests such as labour security, rather than running the

airline with the highest possible profit. Whatever the attractiveness of monopoly or state-owned companies might be in theory, their drawbacks have come increasingly into view. The article by Yergin et al (2000) argues for state-owned firms having difficulties adapting, innovating, and being competitive. In addition, too often they are constrained by political intervention, particularly prone to strikes, over manning, and poor labour relations.

With the above arguments, we assume that the "monopolistic competition" in the EU is not better on profitability than the liberal competition in the US. The reasoning for this statement is that most of the airlines competing within EU lose focus on cost while at the same time trying to cut prices to keep entrants at a safe distance. So in this case, the US airlines should be able to generate higher profit, compared to their European rivals.

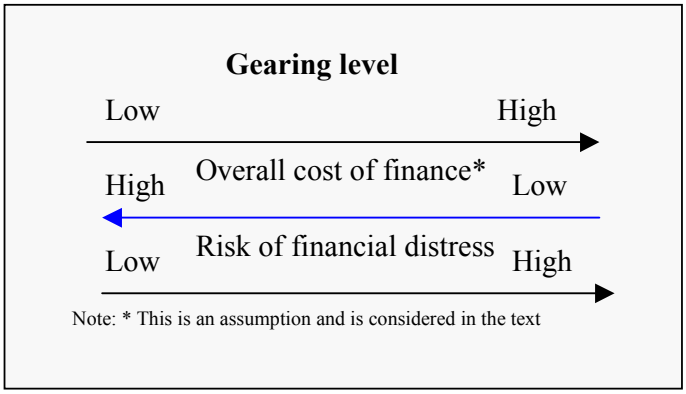
4.3 Capital structure

The solidity (capital structure) determines the degree of losses that can be experienced by the firm before the creditors start experience losses. It will have a direct impact on the cost of capital, faced by the firm. If a firm were to increase its equity, it could reduce the capital risk to other creditors but equity is the most expensive form of financing because it has to absorb losses first. According to Leigh & Olverén, (2000), a measure of this concept is the equity over asset measure (solidity).

Solidity is an important factor for many reasons, but foremost and as a starter, the following example holds; A company which has a high level of borrowing relative to its equity base is subject to more risk than a company that holds a lower level of borrowing (assuming all other factors held constant). Furthermore, if the geared-up firm is in a volatile business as the airline business, it will be subject to even more risk. Take the economic business cycle versus the oil-price for example, as the fuel cost amounts to approximately 13 percent of the total operating costs for an airline company. If then the oil price suddenly increases as it did during the Gulf war, the airline company with a high gearing rate might be unable to meet its fixed

cost in interest charge. It might then in such a scenario be forced to increase fare prizes to such a degree that the passengers will not be keen to fly anymore in order to cover their fixed interest costs, and therefore be forced into liquidation by the banks (creditors). This is why a company with higher gearing it said to be more risky than one with relatively higher equity base. Debt financial securities present a lower risk than shares for the finance providers because they have prior claim on annual income and in liquidation. In addition, security is often provided and binding agreement imposed.

It is appropriate at this time to further stress that in this thesis we are dealing with accounting values for debt and equity. The true values (market value) of debt and equity could not be carried out because the report is dealing with data covering a ten-year period. Further, for the purpose of this study it is not vital to discuss the theories of optimal capital structure (if one exists, that is), rather an understanding that different capital structures have an effect on company performance, and that the formation of capital structure lies at neither extreme of the spectra.



Source: Arnold. G. Corporate Financial Management, 1998 pp 777

Figure 4.4 Gearing level

Note the crucial assumption in the figure above. This is just for illustrative purposes and it must be stressed that this relationship does not always hold, according to Arnold (1998) it will only hold to a certain stage. It is unrealistic because as the risk of financial distress rises, ordinary shareholders are likely to demand higher returns, and therefore at a crucial point the overall cost of finance will start to increase again.

One variable that we assume to affect profitability (profit margin) in the airline business is the equity/asset ratio, which explains how the company is financed. This is not to say that it will be significant for profit margin, but rather that it might, and that we will test if it can prove to have a relationship with higher/lower profit margin. A part of the reasoning behind this assumption is the complex ownership structure within airlines and in particular the European state owned airlines. “State owned” is a loaded word and you do not need to be a scientist to understand that if you have the state providing you with funds, management of that airline is then very likely to take on higher risk. In this case more debt and in some cases maybe to the extent that when a economic slump comes along the airline will be forced into urgent need of additional funds in order to avoid liquidation. According to our financial data, the U.S airline companies are on average financed approximately 40 percent with equity and 60 percent with debt and the European approx. 30 percent with equity and 70 percent with debt. This relationship is interesting for many reasons but for this thesis for the following: The shareholders should in theory be able to put more pressure on the U.S airlines, than on the European, to provide as high profit as possible. Airlines should be as efficient as possible on both the revenue side as on the cost side, as shareholders have a larger stake in the business. More pressure resulting in efficient usage of assets should result in higher profit margin. Furthermore, more pressure on management, should in theory, lead to a more cost conscious and efficient airline company.

5. Empirical Results & Analysis

In this section, we present the quality and characteristics of the data, and the results from the analysis. This first section provides descriptive statistics, followed by the statistical analysis and comments.

5.1 Descriptive Statistics

5.1.1 Dependent Variable

First, we would like to describe the evolution of profit margin over time, as it is the dependent and most important variable. All the descriptive statistics are summarized in the two tables below. Table 5.1 contains all the descriptive statistics for the EU airlines, while Table 5.2 contains the statistics for the US airlines.

Table 5.1 Descriptive statistics on profit margins for EU airlines

	Mean	Median	St.Dev.	Sample Var.	Min.	Max	N
1993	-0.015	-0.008	0.075	0.006	-0.262	0.090	25
1994	-0.021	0.016	0.131	0.017	-0.562	0.106	26
1995	0.031	0.031	0.056	0.003	-0.081	0.155	25
1996	0.042	0.026	0.042	0.002	0.001	0.133	13
1997	0.038	0.048	0.070	0.005	-0.249	0.132	22
1998	0.045	0.046	0.091	0.008	-0.275	0.229	23
1999	0.016	0.017	0.063	0.004	-0.206	0.111	20

Table 5.2 Descriptive statistics on profit margins for US airlines

	Mean	Median	St.Dev.	Sample Var.	Min.	Max	N
1993	0.006	0.002	0.049	0.002	-0.080	0.091	12
1994	0.013	0.015	0.056	0.003	-0.077	0.103	15
1995	0.044	0.034	0.044	0.002	-0.054	0.131	17
1996	0.053	0.062	0.047	0.002	-0.056	0.114	9
1997	0.064	0.081	0.052	0.003	-0.026	0.150	18
1998	0.081	0.095	0.068	0.005	-0.062	0.223	19
1999	0.067	0.077	0.068	0.005	-0.104	0.163	18

When comparing the average profit margin (mean from Tables 5.1 and 5.2) for every year, we can see a clear indication that the EU airlines under-perform compared to their US counterparts (Figure 5.1). This is an observation that clearly supports the statement in the problem discussion, where we argued that deregulated market conditions provide higher profitability. In Figure 5.1, we have also added polynomial trend-lines for both continents. These trend-lines, based on visual observations, indicate steeper downturn for EU airlines when a market slowdown occurs (as it does in the later part of the nineties).

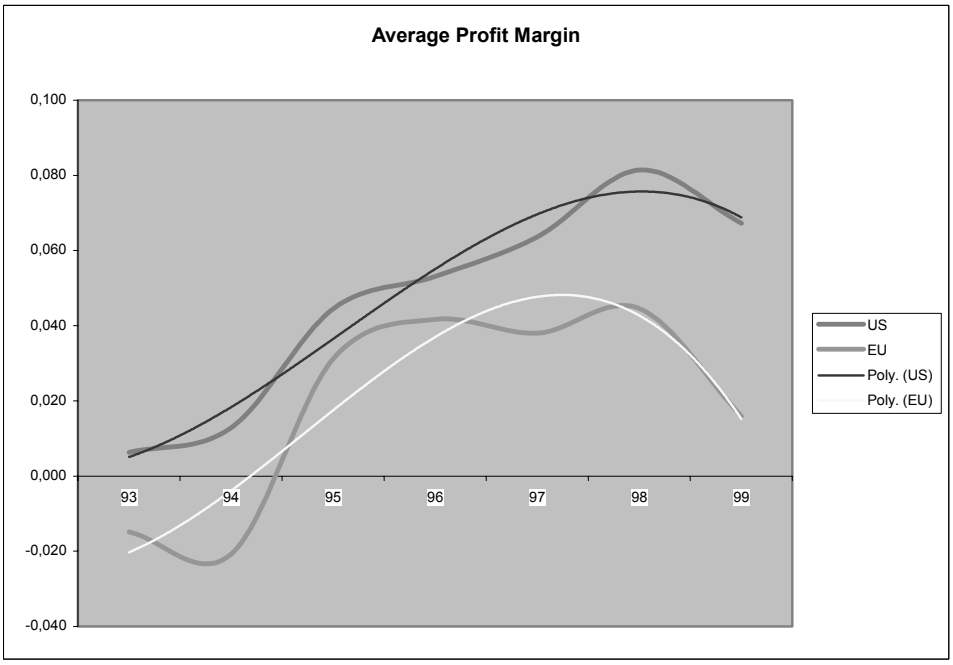


Figure 5.1 Profit margin in the US and EU

So far, it seems as the earlier statements on profitability and market reaction hold concerning the US and EU airline industry. Consequently, a slower response rate to market changes under regulated conditions suggestively occur (Winston, 1998), i.e. EU airlines have lower profitability compared to the US.

The descriptive statistics also indicate a disturbing issue for the coming regression, that is an upward trend in the dependent variable, possibly causing autocorrelation or heteroskedasticity when measuring the data according to OLS. Both these computation error-terms, indicate trends/patterns in the

residuals. If such computation errors exist, an inequitable relation between the dependent and independent variables might occur. This will be tested for using Durbin-Watson test and residual plots before we go in to the regression analysis.

5.1.2 Independent Variables

For the other independent variables, we will not present such detailed descriptive statistics for every year, as we are not searching for annual trends in these. We rather chose to divide them into two periods since these are the chosen periods to be analysed, i.e. 1993-1996 and 1997-1999, which follow in the tables on the next page. Table 5.3 contains the statistics for the EU airlines and the Table 5.4 contains the same data, but for the US airlines.

Table 5.3 Descriptive statistics, 1993-1996, for the independent variables, EU

	Mean	Median	St.Dev.	Sample Var.	Min.	Max	N
Size	3416713	1263159	4377034	1.92E+13	14060.31	16601348	89
Labour	333.66	244.70	457.20	209039.3	24.947	4263.69	89
Capacity	0.639	0.649	0.086	0.0074	0.407	0.857	89
Scheduled	0.942	0.991	0.104	0.011	0.543	1	89
Passenger	0.743	0.747	0.156	0.024	0.501	1	89
Solidity	0.272	0.265	0.139	0.019	0.00048	0.719	89

Table 5.4 Descriptive statistics, 1997-1999, for the independent variables, EU

	Mean	Median	St.Dev.	Sample Var.	Min.	Max	N
Size	2238906	160060.4	4971347	2.47E+13	2939.541	22279486	65
Labour	299.87	259.30	189.60	35985.62	44.04	821.10	65
Capacity	0.669	0.659	0.082	0.0067	0.491	0.952	65
Scheduled	0.922	0.987	0.136	0.019	0.380	1	65
Passenger	0.827	0.884	0.168	0.028	0.381	1	65
Solidity	0.254	0.197	0.183	0.033	0.006	0.648	65

There are particularly large changes in the descriptive statistics in the two periods from Tables 5.3 and 5.4. A few small comments are that share of passenger traffic seems to have increased on average from the first period to the second, as it has increased from 0.743 to 0.827. Further, solidity seems to have dropped a bit from 0.272 down to 0.254, with an increasing standard

deviation from 0.139 up to 0.183. Labour productivity has decreased from an average of 333.66 to 299.87.

According to our model and the expected outcomes from the variables and their effect on profit margin, it seems as if EU airlines have become less profitable in the second period compared to the first. The changes in the variables that occur between 1993-1996 (Table 5.3) and 1997-1999 (Table 5.4), all go in the direction of lower profitability, if our arguments from Chapter 3 (Conceptual Framework) hold regarding the variables and their impact on profit margin.

Table 5.5 Descriptive statistics, 1993-1996, for the independent variables, US

	Mean	Median	St.Dev.	Sample Var.	Min.	Max	N
Size	5225013	2690194	5713933	3.26E+13	42270	18104371	53
Labour	391.74	370.08	194.53	37841.12	82.105	1375.22	53
Capacity	0.663	0.653	0.048	0.0023	0.579	0.808	53
Scheduled	0.935	0.995	0.157	0.025	0.287	1	53
Passenger	0.822	0.857	0.145	0.021	0.287	1	53
Solidity	0.381	0.372	0.116	0.014	0.118	0.657	53

Table 5.6 Descriptive statistics, 1997-1999, for the independent variables, US

	Mean	Median	St.Dev.	Sample Var.	Min.	Max	N
Size	5046515	1370734	6902991	4.77E+13	57809	21767277	55
Labour	373.49	365.97	174.94	30604.26	52.979	871.47	55
Capacity	0.676	0.670	0.0650	0.0042	0.532	0.939	55
Scheduled	0.957	0.999	0.103	0.012	0.504	1	55
Passenger	0.863	0.877	0.111	0.012	0.504	0.999	55
Solidity	0.410	0.399	0.150	0.022	0.002	0.818	55

For the descriptive statistics from Table 5.5 and 5.6 on the US airlines, they also change fairly little from the first period (1993-1996) to the second (1997-1999). The interesting observation here is when the EU airline seems change to “a lower profitability level” on the independent variables, the US airlines change in an opposite direction. According to the directions of changes on the independent variables from Chapter 3 (Conceptual Framework), the US airlines should have higher profitability in the second period compared to the first, and according to Figure 5.1 they do. According to Figure 5.1, the fall in profit margin in 1999 is much lower for US airlines than for EU airlines.

Further, when EU airlines stop growing after the first period, the US airlines seem to continue to increase profitability up until 1998. It is now left to see if these changes, based on the above rational observations, materialize themselves in the coming regression analysis.

5.2 Regression Analysis

The Two periods

To create a more credible analysis, we divided the data sets into two periods, 1993 until 1996, and 1997 until 1999. The two periods are in fact one booming period for the industry and one considered a low-growth period. In addition, we want to capture the final deregulation act in EU, ending in 1997. This is an attempt to capture if there were different variables affecting profit margins in the EU before, contra after the deregulation. The final deregulation act and the economic slowdown in the second period could cause a disturbing issue, i.e. two possible changes affecting performance in that period. Isolating which effect comes from what could be difficult, even though we are still expecting to pick up the possible structural changes in the scope and scale variables and the ability to adapt to market changes.

5.2.1 Correlation Matrix

Before we begin with the regression analysis, we must determine if there exists any disturbing internal correlation between the variables. Internal correlation could cause an unreasonably high R^2, also internal correlation could create difficulty when deciding which impact came from which variable. We divided the data for each continent into two periods; hence, we will present two correlation matrices for each continent. According to Hill, Griffiths & Judge (2001), we have decided that we will accept correlation of ±0.70 between the variables. There is no suggested value for internal correlation, but since the R^2 is not expected to be very high, we believe we can justify such a high correlation.

Table 5.7 Correlation matrix US, 1993-1996

US 93-96	*Profit Margin*	*Size*	*Labour Productivity.*	*Cap. Cost*	*Share of Scheduled*	*Share of Passenger*	*Solidity*
Profit Margin	1						
Size	0.26	1					
Labour Productivity.	0.21	-0.01	1				
Cap. Cost	-0.29	-0.56	-0.15	1			
Share of Scheduled	0.03	0.35	-0.47	-0.30	1		
Share of Passenger	-0.08	0.09	-0.63	0.00	0.90	1	
Solidity	0.43	-0.01	0.02	0.18	-0.05	-0.02	1
Years	0.36	0.08	-0.09	0.01	0.17	0.20	0.16

Table 5.8 Correlation matrix US, 1997-1999

US 97-99	*Profit Margin*	*Size*	*Labour Productivity.*	*Cap. Cost*	*Share of Scheduled*	*Share of Passenger*	*Solidity*
Profit Margin	1						
Size	0.07	1					
Labour Productivity.	-0.47	0.16	1				
Cap. Cost	0.12	-0.34	-0.41	1			
Share of Scheduled	0.24	0.26	-0.27	-0.18	1		
Share of Passenger	0.41	-0.18	-0.63	0.21	0.75	1	
Solidity	-0.22	-0.03	0.32	-0.17	0.27	-0.07	1
Years	0.03	0.09	-0.15	0.09	0.10	0.12	-0.04

In Tables 5.7 and Table 5.8, we have presented the correlation matrixes for the US. We can see that for the first period (Table 5.7), ranging from 1993-1996, the correlation between share of passenger traffic and share of scheduled traffic is 0.90. This is so high that we will remove share of scheduled traffic from the 1993-1996 regressions. The correlation between the two variables is reduced to 0.75 in the next period (Table 5.8), but not enough to be included in the regression for 1997-1999. For the other variables, there are no disturbingly high correlation values.

Table 5.9 Correlation matrix EU, 1993-1996

EU 93-96	*Profit Margin*	*Size*	*Labour Productivity*	*Cap. Cost*	*Share of Scheduled*	*Share of Passenger*	*Solidity*
Profit Margin	1						
Size	0.34	1					
Labour Productivity	0.17	0.07	1				
Cap. Cost	-0.08	-0.36	0.16	1			
Share of Scheduled	0.06	0.37	-0.03	-0.26	1		
Share of Passenger	-0.21	-0.58	-0.11	0.19	0.22	1	
Solidity	0.00	0.04	0.03	-0.14	0.24	-0.03	1
Years	0.26	0.22	-0.06	0.05	0.03	-0.11	0.22

Table 5.10 Correlation matrix EU, 1997-1999

EU 97-99	*Profit Margin*	*Size*	*Labour cap.*	*Cap. Cost*	*Share of Scheduled*	*Share of Passenger*	*Solidity*
Profit Margin	1						
Size	0.11	1					
Labour cap.	0.09	0.35	1				
Cap. Cost	-0.24	-0.43	-0.12	1			
Share of Scheduled	0.16	0.21	-0.03	-0.17	1		
Share of Passenger	-0.03	-0.40	-0.47	0.18	0.63	1	
Solidity	-0.00	0.10	0.14	0.00	0.04	-0.22	1
Years	-0.11	-0.01	0.08	-0.02	-0.11	-0.03	-0.05

The Tables 5.9 and 5.10 illustrate the correlation for the EU variables. As the highest value for any correlation is 0.63, we do not see any problem in utilizing these variables in the coming regression analysis for the EU airlines.

The analysis is based on the statistical equations described earlier under Chapter 3.3. The basic results are summarized in tables for further explanation, but the entire data sets are left to the appendix. The following tables contain the coefficients, t-statistics, and the adjusted R^2. We would like to stress at this point that there was, according to Durbin-Watson test, no sign of autocorrelation in any of the regression computations. The Durbin-Watson test was performed in SPSS and a Durbin-Watson number was produced. This number should clearly differentiate from the critical value of 2.00 if there is autocorrelation. The numbers from our regressions were from 1.97 to 2.1. Residual plots were also produced for every variable to examine the possibility of heteroskedasticity. No obvious indications of such computation error were found either, and the residual plots can be found in Appendix 3 and 4.

5.2.2 The Period 1993-1996, US

When running all the variables (except share of scheduled traffic, because of the high correlation) for the first period (***First***, Table 5.11), not many variables proved significant on a 5% level with critical t-value of 2.00. According to Table 5.11, we can observe that capacity related costs, solidity, and the year variable were significant. None of our variables describing economies of scope seemed to be significant during this period. The adjusted

R^2 was relatively high (R^2 = 0.353). Taking into account that only three of seven variables are significant, an explanatory degree of 35.3% is not bad.

Table 5.11 Regression analysis for the US, period 1993-1996

The Regression Output from the US Market				
	First Period 93 - 96		***Second*** Period 93 - 96	
	Coefficient	*t-value*	*Coefficient*	*t-value*
Intercept	0.135	1.1199	0,153	1,838
Size	7.86E-10	0.638	-	-
Labour Productivity	4.16E-05	1.070	4,80E-05	1,615
Capacity Related Costs	-0.332	**-2.189**	-0,381	**-3,118**
Share of Scheduled Traffic	-	-	-	-
Share of Passenger Traffic	-0.018	-0.347	-	-
Solidity	0.185	**3.574**	0,188	**3,712**
Year	0.016	**2.678**	0,016	**2,763**
N	53		53	
Adjusted R^2	0.353		0.373	

Running a regression with too many insignificant variables can affect the outcome, so we decided to run a second regression for this period, named "***Second***". This second regression contains only four variables, i.e. the four variables having the highest t-values during the first regression. Nothing happens with the variables that are significant, i.e. capacity related costs, solidity, and years. We included labour productivity in the second regression, and the t-value increased but not enough to reach a 5% level of significance[9]. By reducing the number of insignificant variables in the equation, we managed to increase the adjusted R^2 to 0.373, which means our model has now an explanatory degree of 37.3%. Moreover, all the mentioned significant variables are significant not only on a 5% level, but even on a 1% level as the critical value for a 1% level is 2.66 and all our respective t-values are higher than that.

[9] For the record, labour productivity is significant on a 11% level

We would also like to stress that the directions of the significant variables, meaning the positive or negative impact they have on profitability, were just as expected. Reduced capacity related costs, increased solidity and the market conditions for airlines, have a positive effect on profit margin during this period. Reduced capacity related costs were also proven by Antoniou (1992), but in addition he got the labour productivity, share of scheduled and passenger traffic significant in his data from the year 1985.

5.2.3 The Period 1997-1999, US

For this period, the results from the variables are different, as Table 5.12 shows, and we therefore divide the data in two regressions (***First*** and ***Second***). In the first regression labour productivity is the only variable significant, but only on a 10% level, with a t-value of –1.718 where the critical t-value is –1.67. The adjusted R^2 is naturally low with its 0.197, as barely one variable goes clear.

According to the second regression, which is not a multiple regression, but only contains labour productivity as independent variable, we can clearly observe that the labour productivity measure is quite important for profitability, with a t-value of –3.193 and the critical value is only 2.00 on a 5% level. Actually, the adjusted R^2 has also increased to 0.203, which means that labour productivity explains alone 20.3% of US airlines profitability.

Table 5.12 Regression analysis for the US, period 1997-1999

The Regression Output from the US Market				
	First Period 97 - 99		***Second*** Period 97 - 99	
	Coefficient	*t-value*	*Coefficient*	*t-value*
Intercept	0.021	0.148	0,129	7,757
Size	1.59E-09	1.345	-	-
Labour Productivity	-0.0001	-1.718	-0,00016	**-3,913**
Capacity Related Costs	-0.005	-0.036	-	-
Share of Scheduled Traffic	-	-	-	-
Share of Passenger Traffic	0.130	1.469	-	-
Solidity	-0.044	-0.889	-	-
Year	-0.005	-0.569	-	-
N	55		55	
Adjusted R^2	0.197		0.204	

Labour productivity, was as mentioned proven significant, also with a satisfying explanatory value for being only one independent variable in a regression. What makes this result special is that it affects profitability negatively, which means that airlines with "low" labour productivity have the highest profit margin. This clearly contradicts the hypothesis, and the study by Antoniou (1992).

5.2.4 The Period 1993-1996, EU

The absence of explanatory variables from the regressions in the period 1993-1996 (Table 5.13) is not really surprising, although the result contradicts practically every hypothesis that we stated regarding the independent variables and their impact on profit margin. This result supports the earlier arguments of inefficient airlines in a regulated environment. The few exceptions in this result are for size and the variable for years. After the second regression (to eliminate some insignificant variables and increase the explanatory degree, R^2 from 0.109), it is quite clear that larger airlines generate higher profit margin, as size has a t-value of 2.810 and critical value

is 2.00 on a 5% level. Years has a slightly lower t-value of 2.02, but still goes clear of the 5% level and significance. The R^2 increases to 0.146, which still is quite low, considering our model only explain 14.6% of EU airlines profit.

Table 5.13 Regression analysis for the EU. period 1993-1996

The Regression Output from the EU Market				
	First Period 93 - 96		***Second*** Period 93 - 96	
	Coefficient	*t-value*	*Coefficient*	*t-value*
Intercept	-0.0001	-0.001	-0,067	**-2,904**
Size	6.35E-09	1.802	5,89E-09	**2,810**
Labour Productivity	3.26E-05	1.583	3,17E-05	1,616
Capacity Related Costs	-0.035	-0.291	-	-
Share of Scheduled Traffic	-0.055	-0.453	-	-
Share of Passenger Traffic	0.013	0.148	-	-
Solidity	-0.024	-0.340	-	-
Year	0.019	1.964	0,018	**2,020**
N	89		89	
Adjusted R^2	0.109		0.146	

As we stated, the results from this regression contradict almost all profitability hypotheses, but support the fact that EU airlines under perform compared to US airlines. Defining a model that explains EU airlines profit margin seems much more complex and possibly more individually oriented, than explaining the profit margin for US airlines. We will continue with the second period, from 1997-1999 to see if any changes have happened to the independent variables and their effect on profit margin.

5.2.5 The Period 1997-1999, EU

For this period, we also had to do two regressions, the first and the second in Table 5.14. The first regression gives a vague indication that capacity related costs are relevant to profit margin, but with a t-value of –1.540 and adjusted R^2 of pitifully 0.00. Therefore, we made the second regression and capacity

related costs proved significant on a 5% level, with a t-value exactly like the critical value of 1.98. The adjusted R^2 also increased to 0.044, which indicates that capacity related costs only describe 4.4% of profit margin.

Table 5.14 Regression analysis for the EU, period 1997-1999

The Regression Output from the EU Market				
	First Period 97 - 99		***Second*** Period 97 - 99	
	Coefficient	*t-value*	*Coefficient*	*t-value*
Intercept	0.130	1.074	0,183	2,408
Size	-2.26E-09	-0.791	-	-
Labour Productivity	1.73E-05	0.277	-	-
Capacity Related Costs	-0.201	-1.540	-0,223	**-1,981**
Share of Scheduled Traffic	0.159	1.202	-	-
Share of Passenger Traffic	-0.097	-0.804	-	-
Solidity	-0.033	-0.616	-	-
Year	-0.010	-0.817	-	-
N	65		65	
Adjusted R^2	0.00		0.044	

Based on studies by Winston (1998) and Yergin et al (2002) the assumption is that the third deregulation act should affect firm performance for EU airlines. The natural assumption is that airlines gradually adapted during the years before 1997, making them better suited to the new liberalized competitive market. This does not prove to be the case. The result presented here actually upholds the arguments in our problem discussion, where firms operating in a regulated environment fail to effectively adapt to market changes. The incentive to change, provided by the deregulation act, did not have any immediate effect on profit margin. It could possibly have faded in the market slow-down as at least one scale effect proved significant. However, we see this as highly unlikely as a market slow-down in itself should have forced economies of scale in to the EU airline industry.

5.2.6 Summary of Regression Results

Table 5.15 The significant variables for the two periods for US and EU

	US Airlines		EU Airlines	
	1993-96	1997-99	1993-96	1997-99
Size			+*	
Labour Productivity	+**	+***	+**	
Capacity Related Costs	+*			+
Share of Scheduled Traffic				
Share of Passenger Traffic				
Solidity	+*			
Year	+*		+	

* significant on a 1% level
** only significant on 11% level, where the others are significant at a 5% level
*** opposite effect on profitability than predicted

The results from our regressions differ between US airlines and EU airlines. The significant variables in each equation are summarized in Table 5.15. We have clear indication through the relatively high R^2, that our variables describe parts of the profitability among US airlines. With the low R^2 and the few significant variables for EU airlines, the general profit margin seems still unexplained. An unproven argument is still if US airlines have higher profitability than EU airlines, which will now be tested.

5.3 Statistical Comparison of Profitability in US versus EU

5.3.1 Chow Test for Model Significance

The model used for US and EU airlines, included the same variables, and were based on the same data background. The data were also divided into two periods, i.e. 1993-1996 and 1997-1999. An open question is still if the two continents are comparable with the same model. According to, Hill et al (2001) there are tests for model significance and one such test is a Chow test. The Chow test makes it possible to compare US and EU, and to see if the data for the variables in the two continents are applicable in the same regression model. The null hypothesis in a Chow test is if the two data sets are

comparable with one another in the same model. There are two alternative outcomes from this test:

1). *Keep null hypothesis*. The model is significant for both US and EU and only a shift in the regression curve is a possible difference. This indicates that the data for the variables are comparable and a joint analysis of US and EU can be performed.

2). *Reject null hypothesis*. The data sets contain too large differences to be compared, or pooled in the same model. Comparing results from US and EU will not be feasible with this outcome.

A Chow test, also known as an F-test, produces an F-value based on the "sum of squared residuals" generated by the regression[10]. This F-value is compared with a critical value from an F-distribution Table. There are two equations in this test (1. and 2. below), where the first tests if the two continents can be together in a model, and the second tests whether they are stable, hence, if US can explain EU.

The first tests if we can run US and EU in the same model, using the equation 1. below.

1. $$F = \frac{(RRSS - RSS_{EU}) / n_{US}}{RSS_{EU} / (n_{EU} - k - 1)}$$

The second tests if US is appropriate to explain EU, using the equation 2. below.

2. $$F = \frac{(RRSS - RSS_{US}) / n_{EU}}{RSS_{US} / (n_{US} - k - 1)}$$

[10] The *RRSS* in equations 1. and 2. stands for "the sum of squared residuals" in a regression containing both US and EU data and all variables. The $RSS_{\text{EU or US}}$ stands for "the sum of squared residuals" for individual regressions of US and EU. These residual values are standard output in regression analysis. The *n* is number of observations and k is degrees of freedom.

The result from these two tests is presented together with the appropriate critical values. We have chosen to use a critical value on a 1% level, since all results are either accepted or rejected no matter what thecritical value.

Table 5.16 Chow test for model significance and data stability

The Periods	*F-value for the first test (1.)*	*F-value for the second test (2.)*	*Critical Value (1%)*
1993-1996	0.335	**3.247**	1.84
1997-1999	0.66	**1.986**	1.84
1993-1999	0.565	**2.589**	1.00

According to the results presented, in Table 5.16, we must keep the null hypothesis for all periods regarding the ability to test US and EU data together. This means that the data collected for the two continents is stable regarding the residuals, and this test then indicates a likelihood that these two samples describe the same factors. In other words, the two data sets are alike in structure and should cover the same areas. In the second test, we must reject the null hypothesis that the US data explains the EU data. According to Hill et al (2001), this means that the two data sets contain such differences that one cannot explain the other, but as in the first test, they are likely to cover the same area of exploration.

5.3.2 Highest Profit Margin

The previously proven distinction between US and EU is important as one or several factors must differ, although the data sets are consistent regarding the variables. As we can see from the earlier regression analysis in Tables 5.11 and 5.12, the same variables are obviously not explanatory variables for both US and EU, at the same time. To answer the third hypothesis that profitability should be higher in the US, we run a regression with both continents pooled in a regression. Profit margin was set as the dependent variable and a dummy variable for US/EU as independent, and the periods were again split in two.

Table 5.17 Results from the dummy regression on profitability and US/EU

Periods	*Coefficient*	*t-value*	*Adjusted R^2*
1993-1996	0.024	1.742	0.014
1997-1999	0.037	**2.951**	0.059
1993-1999	0.034	**3.523**	0.042

From the dummy test, we found that profitability is higher for US airline than for EU airlines, as the critical value for the t-test is 2.00 on a 5% level on the second period from 1997-1999. The first period is also significant but only on a 90% level where the critical t-value is 1.70. For the entire data series US proves to be better yet again. We must stress that the R^2 is very low in all regressions.

Comments on the low R^2

The R^2 is low in all our regressions (Tables 5.11 to 5.14) considering the amount of variables present. Clearly, a higher degree of explanation would have been beneficial. The R^2 from the dummy analysis (Table 5.17) is also low, approximately 5% explanation for one single dummy variable. Although this is low, we believe we have proven that there are differences, possibly due to regulation, and that US perform significantly better than EU airlines.

5.4 Review of the Analysis

The airline industry has gone through major structural changes. These changes are results of deregulation and other government policies but also a reaction to changes in technology, mainly IT, and to an increasing global demand for air transportation of both freight and passengers. The US airline industry has shown the way for the deregulation process as it deregulated the industry twelve years before the European airline market. There appear to be many dissimilarities when comparing these two markets; The US market has fewer but larger companies, less fast-trains competing on short-haul routes, less competition from charter operators, lower cost structure, the labour unions have less power, a uniforme infrastructure, and finally they have a standard air navigation system. Apart from the above-mentioned differences,

the European airline market has, for a long period, been protected by their ownership structure, subsidiaries, and protectionist strategies.

5.4.1 Similar Data for US and EU

The two markets have many similarities, which made the two markets interesting as test objects for this thesis. Deregulation is said to bring forward many effects into the business environment and this was also the basis for the analysis.

The Joint F-test that we conducted, also known as the Chow test, proves that the data for the US and EU variables are based on the same content, it also clearly proves that differences in the variables between US and EU exist. This means that the variables affecting profit margin in the US do not necessarily have to affect profit margin in EU.

5.4.2 Highest Profit Margin for US Airlines

In addition, we further prove using a dummy regression that profitability is higher for US airlines compared to EU airlines. This supports the earlier arguments that operating in a deregulated market environment should generate higher profit margin. Where Winston (1998), Gowrisankaran (2002), and Rundqvist and Schön (1998) claim this to be true from a qualitative standpoint, we prove this statement using regression approach. We believe this relationship to derive from the fact that the US market is more liberal concerning the competitive environment, meaning that the US airlines are forced to operate more efficiently in order to stay in business, and therefore can show a higher profit margin. This has not been the case in Europe up until the final deregulation act in 1997. The regulatory environment in Europe has before 1997 kept the European airlines under rigorous control, resulting in reduced flexibility and difficulties to adapt to internal and external shocks. Any immediate effect of this deregulation seemed to be the case.

5.4.3 The Period 1993-1996

The factors we have utilized as independent variables to explain profitability among airlines, was supported by theory and previous studies on profitability (Antoniou, 1992; Doganis, 1991; Caves et al, 1984; Leigh & Olverén, 2000).

Even so, the significance was not convincing for the lot of the variables. They also clearly deviated from US to EU airlines, as Figure 5.2 illustrates.

We argued earlier that US airlines should have a higher degree of cost effectiveness evolving from the liberal competitive market situation. Two of our variables from economies of scale, i.e. capacity related costs and labour productivity (labour, only to a smaller extent), seems relevant for profitability among US airlines in the first period 1993-1996. In addition, solidity was significant for US airlines in that period, which were argued since airlines are in constant capital need from large investments and operating costs. The variable for the time aspect, years, is also significant, and indicates a general increasing trend in profitability, most likely a high growth market period (see Figure 5.2). The regression also indicates that the model explains 37% of profitability among airlines. This is relatively high, in the context of few significant variables.

On the other hand, EU airlines do not get the same significant variables as the US airlines. These findings support the earlier arguments that effectiveness etc might not materialize itself in the same way as in a regulated market. Size is clearly significant, this could indicate that market power, and control are important. Labour productivity could have a smaller effect on profit, but in contrast to US airlines, capacity related costs are not significant here. The time variable becomes significant, even for EU airlines, which makes the assumption that a general increasing market trend affects airlines overall positively (see Figure 5.2). The regression indicates that the model explains 14% of profitability among EU airlines, although a low number, it is a good indication that different variables affect EU airlines versus US airlines.

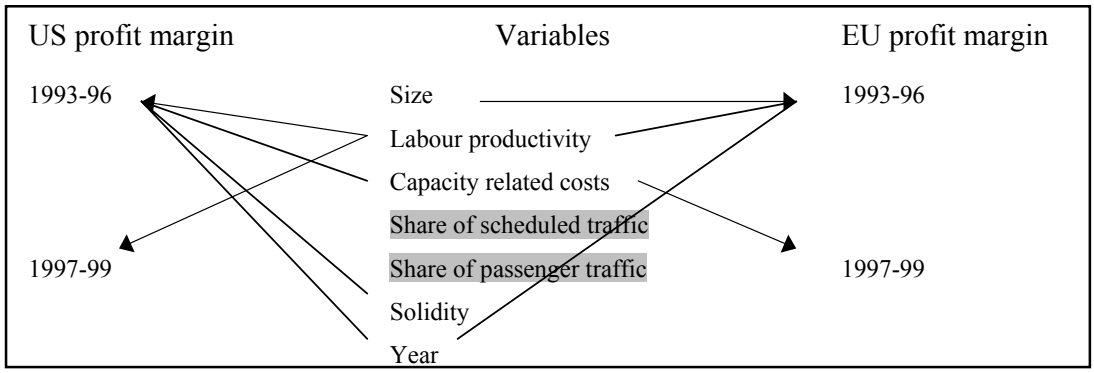


Figure 5.2 Variables affecting profit margin in the two markets

Two variables were not significant for the US or EU in any period or year, i.e. share of scheduled traffic and share of passenger traffic (see Figure 5.2). Antoniou (1992) found these to be significant in the directions argued in Chapter 3, but there are no signs of this from our results. Antoniou's data was from 1985 and one explanation could be that the market situation has changed and become tougher during the past decade. A reason for this insignificance might be that airlines were during these years forced to cut prices in all operations, despite regulatory environment, eliminating excess profit opportunities.

5.4.4 The Period 1997-1999

For this low growth period, 1997-1999, the results were quite surprising for both US and EU airlines. The only significant variable for US airlines was labour productivity, but the impact was in the opposite direction from what we expected. This unexpected result indicates that the more employees per tonne-kilometres, the higher the profit margin. The airline industry is a service industry and one explanation for this result could be just that; the more employees one can have on hand in relation to tonne-kilometres available, the better one can serve the customers. This only seems to occur in a low-growth period, not in the high growth. A possible explanation could be that business travellers are more important in a low-growth perspective. Business travellers are the highest paying customers as they fill only a fifth of the seats but provide half of the revenue (The Economist, 2002), and for business travellers flexibility is highly appreciated along with quality and comfort. To obtain such a service level, the airline needs to increase the amount of labour.

Again, the regression produces a different result for EU airlines, as only capacity related costs are significant for the last period from 1997 to 1999 (see Figure 5.2). In 1997, the third deregulation package was initiated and we assumed a possible change in variables affecting profitability. The change occurred but not in any conclusive direction. Far too few variables are significant for such a conclusion. The fact that capacity related costs are significant could indicate that EU airlines have become more cost effective, possibly explained by the liberalized competition followed by the emergence of low cost airlines.

5.4.5 Closing Remarks

There could be several reasons for these unexpected results. Airlines are large organisations, which makes it difficult for them to change in a short period. We expected the changes for EU airlines to be clearer and several variables significant in the second period, due to the final deregulation. Nevertheless, when markets change, not all players can keep up.

In the limitations in Chapter 1.5 we described subsidizing and off balance sheet financing. The ability to obtain subsidies on single routes or for entire companies is an error term that unfortunately had to be excluded. The economic effect on profit and operations could therefore be significant. The same is the case with off balance sheet financing. When leasing aircraft or services, the balance sheet might not represent the same assets and cost picture as for airlines that own all their planes. Leasing can have effects on the equity/asset ratio (Arnold, 1998), which we use as a measure of capital structure. Depending on how the company treats their lease expense, this can have implications for this ratio. According to Arnold (1998), there are two types of lease arrangements; operating and financial lease. Operational lease commits the lessee to short-term contracts or one that can be terminated at short notice. With a financial lease on the other hand, the financial provider expects to recover the full cost (or almost the full cost) of the equipment, plus interest, over the period of the lease. When leasing in contrast to debt financing, the leasing does not appear as a liability. The solidity ratio therefore seams to be higher than what it in fact is if the asset was purchased with debt. When decreasing the assets by leasing, the annual assets turnover rate will increase, which could result in an unjustified high productivity on the assets compared to peers.

However, according to Arnold (1998), new accounting treatments have been implemented in an attempt to overcome this. Before the new treatments a company could by leasing reduce its gearing ratio and therefore improving its chance of obtaining more borrowed funds. The effects of these accounting tricks have not been treated in this thesis, since we are dealing with accounting data from 1993-1999, and due to the fact that new treatments of these effects are evolving all the time. Another pitfall according to Schefczyk

(1993) with leasing in the airline industry is due to tax regulations; the airline might prefer to purchase the aircraft through a wholly owned subsidiary in a low corporate tax regime. In order to accumulate equity in the low-tax subsidiary and minimize total tax liabilities in the parent company, the parent company might obtain the aircraft through a capital lease with an artificially high rate. In this case, the resulting expense should indicate inefficient use of the aircraft. However, Schefczyk (1993) also points out that details of such a transaction will not be published. If US airlines lease more assets than EU airlines, this could create an unfortunate difference.

One earlier limitation relates to the political environment. There is a political aspect, where the differences in political environment within Europe are still significant. For example, route selection in Europe has been driven for political and strategic reasons, not purely for profit as the route selection in the US. There is also a high degree of government ownership among the traditional European airlines, which could make the ability to change even more complex and time consuming. The same political aspect has also affected the labour market, as labour unions in the EU have greater power than they have in the US. This might affect the profitability as the labour force in Europe are more secure than in the US, making the cost of laying off employees in the US much less than in Europe.

6. Conclusions

This paper intends to identify variables affecting firm profitability in the US and EU airline industry, with respect to economies of scale/scope, capital structure and market differences. Further, we aim to investigate if these variables act differently in the US opposed to the EU market, due to differences in regulatory settings. The above arguments all deal with the hypotheses from the problem discussion, which we later tested in the analysis in Chapter 5. Below, we present a brief summary of the hypotheses and their respective answers:

i) **Economies of scale could be present in the airline industry**
   - Evidently they are, and to a larger extent for US airlines

ii) **Equity financing could have a positive effect on profitability**
   - The analysis proves this to be the case for US airlines in the first period, but not in the second. For EU airlines this variable was not significant in any of the two periods

iii) **Market deregulation could have a positive effect on profitability**
   - The fact that US airlines have higher profit than their EU counterparts seems indisputable

iv) **Economies of scope could be present in the airline industry**
   - According to our variables for economies of scope, the airline industry does not seem to have these possibilities in relation to the variables we tested

These hypotheses were the basis for the analysis of the airline industry. When analysing for economies of scale and scope, we expected to find a difference between the US and the EU market. As the previous section describes, a difference is quite clear, but a consistent relationship between the variables and profitability is not that obvious. The change in variables affecting profitability from a high-growth to a low-growth period and the effect of deregulation, is not as expected. The fact that our model seems to explain a high-growth period better than a low-growth period, is in itself interesting;

obviously the airlines operations and the relation to profit changes, depending on the market situation.

There is a clear indication that US airlines have a higher profit margin than EU airlines, and this is probably the result of the differences in market environment. The variables tested were more significant for US airlines, and they explained a higher degree of profit margin. Our findings point towards further deregulation for open skies across nations and continents, to create stability and efficiency in the industry. This result is further backed by Barry Humphrey's AGM speech this year (2002) as chairman of IATA's Task Force on International Aviation Issues, in which he states the importance of liberalization and deregulation for profitability, efficiency, and stability in the airline industry[11].

After the final deregulation in Europe, the competitive situation increased. The infrastructure was already well developed with rail and fast-train competition, but the deregulation opened another segment; low cost airlines. Low-cost airlines are increasing their market share continuously, and the emergence of this new segment has increased the competition further. The effect of this new segment on established actors could be an interesting topic for further research.

[11] Barry Humphrey's AGM speech can be found in its entirety on IATA's Web page, www.iata.org/

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Appendix 1

Data for EU airlines

Below we present the data and the variables for the EU airlines we investigated. They are presented by years.

State	Name	Year	Profit Margin	Size	Labor Prod.	Cap. Cost	Share of Scheduled	Share of Passenger	Solidity
AUSTRIA	TYROLEAN AIRWAYS	1993	0,088	146009,667	161,135	0,561	1	1	0
AUSTRIA	AUA	1993	-0,087	1227141,08	202,676	0,599	1	0,795	0,356
BELGIUM	SABENA	1993	-0,019	1958313,963	160,52	0,569	1	0,582	0,221
FINLAND	FINNAIR	1993	0,042	1163043,947	229,126	0,756	0,694	0,504	0,284
FRANCE	AIR FRANCE	1993	-0,059	11276891,93	339,977	0,54	0,997	0,581	0,08
FRANCE	AIR INTER	1993	-0,017	1473547,91	129,718	0,732	1	0,948	0,363
GERMANY	LUFTHANSA	1993	-0,001	9029478,717	352,956	0,475	0,999	0,522	0,286
GREECE	OLYMPIC	1993	-0,054	835436,889	169,061	0,566	0,989	0,831	0,141
ITALY	ALITALIA	1993	-0,01	2945571,1	317,439	0,626	0,99	0,612	0,317
ITALY	ATI	1993	0,05	485137,644	4263,691	0,759	0,875	0,858	0,22
ITALY	MERIDIANA	1993	0,046	229580,835	223,419	0,674	0,939	0,922	0,166
PORTUGAL	TAP AIR PORTUGAL	1993	-0,262	946496,078	160,437	0,477	0,962	0,763	0,403
SCANDINAVIA	SAS	1993	-0,008	4604269,95	187,692	0,549	0,998	0,776	0,251
SPAIN	BINTER CANARIAS	1993	-0,118	90442,031	192,812	0,758	1	0,924	0,403
SPAIN	IBERIA	1993	-0,048	4435838,61	192,412	0,604	0,999	0,78	0,408
SWITZERLAND	SWISSAIR	1993	-0,005	4272159,901	251,102	0,65	0,998	0,561	0,282
UNTD KINGDOM	AIR UK	1993	-0,008	187825,708	114,726	0,649	0,961	0,945	0,097
UNTD KINGDOM	LOGANAIR	1993	-0,081	23642,89	50,654	0,714	0,992	0,983	0,301
UNTD KINGDOM	BRITISH AIRWAYS	1993	0,086	11390331,57	330,76	0,53	0,998	0,731	0,214
UNTD KINGDOM	BRITISH MIDLAND	1993	0,001	168589,696	136,004	0,63	0,582	0,554	0,05
UNTD KINGDOM	CATHAY PACIFIC	1993	0,09	7193811,456	516,598	0,696	0,986	0,567	0,19
UNTD KINGDOM	GB AIRWAYS	1993	0,02	14760,698	508,989	0,719	0,759	0,714	0,396
UNTD KINGDOM	JERSEY EUR. AIRWAYS	1993	-0,039	30953,438	60,575	0,692	0,972	0,96	0,046
UNTD KINGDOM	VIRGIN ATLANTIC	1993	-0,032	332350,784	667,517	0,585	1	0,743	0,274
AUSTRIA	AUA	1994	-0,027	1307569,716	206,577	0,6	1	0,79	0,316
FINLAND	FINNAIR	1994	0,094	1456090,883	258,61	0,707	0,821	0,619	0,4
FRANCE	AOM-MINERVE S.A.	1994	-0,043	164085,964	723,221	0,777	0,922	0,748	0,194
FRANCE	AIR FRANCE	1994	-0,039	9815874,466	323,515	0,673	0,996	0,539	0,215
FRANCE	AIR INTER	1994	-0,002	1663781,959	142,138	0,725	1	0,945	0,359
FRANCE	TAT EUROPEAN AIRLINE	1994	-0,133	346097,987	83,969	0,522	0,889	0,667	0,083
GERMANY	EUROWINGS	1994	-0,02	174098,869	100,715	0,727	0,897	0,897	0,088
GERMANY	LUFTHANSA	1994	0,035	9605552,924	370,909	0,476	0,997	0,503	0,44
ITALY	AVIANOVA S.P.A.	1994	0,032	34458,8	24,947	0,767	0,973	0,973	0,143
ITALY	ALITALIA	1994	0,036	3876615	329,018	0,644	0,978	0,646	0,229
ITALY	AIR DOLOMITI	1994	-0,562	66896,844	108,548	0,841	0,815	0,815	0,15
ITALY	MERIDIANA	1994	0,072	201577,474	243,288	0,661	0,947	0,929	0,196
NETHERLANDS	KLM	1994	0,081	9027656,052	440,127	0,637	1	0,533	0,321
PORTUGAL	PORTUGALIA	1994	-0,038	43319	244,706	0,731	0,84	0,831	0,437
PORTUGAL	TAP AIR PORTUGAL	1994	-0,188	1263158,736	170,319	0,407	0,974	0,759	0,46
SCANDINAVIA	SAS	1994	0,029	4167355,248	199,755	0,5	0,998	0,769	0,293
SPAIN	AVIACO	1994	-0,021	425349,232	263,407	0,643	0,997	0,961	0,257
SPAIN	IBERIA	1994	0,017	3610211,92	181,295	0,624	1	0,768	0,23
SPAIN	BINTER CANARIAS	1994	-0,132	71660,499	124,279	0,775	1	0,942	0,252
SPAIN	VIVA AIR	1994	0,025	162238,529	372,779	0,692	0,951	0,925	0,327
UNTD KINGDOM	BRITISH AIRWAYS	1994	0,106	14126691,56	334,044	0,487	0,998	0,721	0,178
UNTD KINGDOM	AIR UK	1994	0,02	217901,793	127,401	0,69	0,95	0,936	0,084
UNTD KINGDOM	BRITISH MIDLAND	1994	0,015	182343,519	131,294	0,657	0,616	0,59	0,125
UNTD KINGDOM	GB AIRWAYS	1994	0,031	20318,666	522,929	0,7	0,543	0,509	0,331
UNTD KINGDOM	CATHAY PACIFIC	1994	0,098	7325149,613	566,39	0,659	1	0,561	0,149

UNTD KINGDOM	VIRGIN ATLANTIC	1994	-0,025	340940,167	795,792	0,586	1	0,725	0,274
AUSTRIA	AUA	1995	-0,021	1651050,056	232,377	0,593	1	0,754	0,281
GERMANY	LUFTHANSA	1995	0,025	12958995,66	499,479	0,625	1	0,501	0,393
ITALY	MERIDIANA	1995	0,069	179210,319	263,698	0,637	0,936	0,92	0,265
FINLAND	FINNAIR	1995	0,105	1530563,083	267,079	0,691	0,851	0,654	0,453
FRANCE	AIR FRANCE	1995	0,031	11313662,75	373,349	0,675	0,998	0,536	0,252
FRANCE	AIR FRANCE EUROPE	1995	-0,062	1739685,277	145,458	0,722	1	0,963	0,382
FRANCE	AOM-MINERVE S.A.	1995	0,001	179848,109	805,842	0,857	0,911	0,766	0,233
GREECE	OLYMPIC	1995	0,058	1001940,185	182,767	0,652	0,988	0,84	0,719
ITALY	ALITALIA	1995	0,038	3977451	361,119	0,647	0,99	0,649	0,214
NETHERLANDS	KLM	1995	0,049	10036379,89	441,548	0,637	1	0,535	0,314
PORTUGAL	TAP AIR PORTUGAL	1995	-0,081	1481816,622	199,327	0,434	0,924	0,712	0,666
SCANDINAVIA	SAS	1995	0,077	4295299,272	203,035	0,555	0,99	0,761	0,365
SPAIN	AVIACO	1995	-0,004	474355,574	272,653	0,64	0,986	0,953	0,252
SPAIN	BINTER CANARIAS	1995	-0,008	78992,609	214,199	0,779	1	0,942	0,186
SPAIN	IBERIA	1995	0,07	3836401,47	198,613	0,621	1	0,752	0,125
SWITZERLAND	SWISSAIR	1995	0,012	6660791,98	287,377	0,63	0,992	0,549	0,33
UNTD KINGDOM	MAERSK AIR	1995	0,063	27562,066	43,397	0,604	0,992	0,956	0,547
UNTD KINGDOM	AIR UK	1995	0,028	251102,94	141,294	0,686	0,974	0,959	0,072
UNTD KINGDOM	BRITISH AIRWAYS	1995	0,117	15700044,81	342,618	0,5	0,998	0,741	0,173
UNTD KINGDOM	BRITISH MIDLAND	1995	0,013	216243,311	142,402	0,657	0,649	0,62	0,109
UNTD KINGDOM	CATHAY PACIFIC	1995	0,155	8573186,4	606,732	0,652	1	0,542	0,153
UNTD KINGDOM	GB AIRWAYS	1995	0,038	16583,822	461,968	0,666	0,746	0,71	0,289
UNTD KINGDOM	JERSEY EUR. AIRWAYS	1995	-0,066	28107,723	112,624	0,521	1	0,998	0,056
UNTD KINGDOM	MANX AIRLINES EUROPE	1995	0,006	14060,309	139,829	0,661	0,78	0,777	0,164
UNTD KINGDOM	VIRGIN ATLANTIC	1995	0,065	456137,6	847,687	0,616	1	0,712	0,275
GREECE	OLYMPIC	1996	0,002	957712,327	209,976	0,677	0,988	0,849	0,641
FINLAND	FINNAIR	1996	0,052	1367063,63	257,165	0,716	0,84	0,624	0,499
FRANCE	AIR FRANCE	1996	0,033	10991397,42	388,177	0,7	1	0,554	0,201
GERMANY	LUFTHANSA	1996	0,026	12392473,6	526,194	0,635	0,996	0,504	0,439
ITALY	MERIDIANA	1996	0,022	166961,74	255,873	0,659	0,958	0,941	0,346
NETHERLANDS	KLM	1996	0,008	9054541,367	455,887	0,667	1	0,549	0,258
SCANDINAVIA	SAS	1996	0,047	5006629,255	216,543	0,563	0,989	0,726	0,403
SPAIN	AVIACO	1996	0,001	532890,036	300,758	0,649	0,95	0,918	0,246
SPAIN	IBERIA	1996	0,088	3664706,472	228,664	0,652	1	0,753	0,434
SWITZERLAND	SWISSAIR	1996	0,009	6924686,019	336,022	0,665	0,959	0,549	0,311
UNTD KINGDOM	CATHAY PACIFIC	1996	0,133	10643482,08	639,948	0,653	0,991	0,535	0,265
UNTD KINGDOM	BRITISH AIRWAYS	1996	0,102	16601347,62	354,337	0,521	0,998	0,734	0,2
UNTD KINGDOM	BRITISH MIDLAND	1996	0,017	301398,095	134,075	0,629	0,693	0,664	0,076
FINLAND	FINNAIR	1997	0,084	1273624,418	264,601	0,692	0,847	0,621	0,595
GERMANY	LUFTHANSA	1997	0,062	12278453,17	755,564	0,631	0,996	0,529	0,433
ITALY	MERIDIANA	1997	0,044	160060,384	266,656	0,664	0,972	0,955	0,381
ITALY	AIR DOLOMITI	1997	0,058	43796,079	123,996	0,694	0,972	0,972	0,278
NETHERLANDS	KLM	1997	0,057	8822614,626	466,787	0,658	1	0,586	0,278
NORWAY	COAST AIR K/S	1997	0,014	2939,541	44,044	0,952	0,979	0,979	0,39
NORWAY	WIDEROE	1997	0,039	190351,368	58,488	0,55	0,993	0,983	0,197
SCANDINAVIA	SAS	1997	0,053	4599902,314	227,253	0,566	0,987	0,702	0,414
SPAIN	AIR NOSTRUM	1997	0,038	41721,046	106,733	0,756	0,985	0,985	0,029
SPAIN	AVIACO	1997	0,056	458422	310,844	0,669	0,893	0,864	0,271
SPAIN	BINTER CANARIAS	1997	0,037	58996,705	366,476	0,772	0,995	0,906	0,186
SPAIN	BINTER MEDIT.	1997	-0,249	24380,489	117,983	0,781	1	0,982	0,098
SPAIN	PANAIR	1997	-0,007	16341,037	250,124	0,862	0,76	0,76	0,267
SPAIN	IBERIA	1997	0,082	3152983,2	245,031	0,657	0,998	0,766	0,458
SWEDEN	MALMO AVIATION AB	1997	0,037	37642,46	124,563	0,628	1	1	0,358
UNTD KINGDOM	BRITISH AIRWAYS	1997	0,068	18616101,91	392,736	0,491	0,995	0,726	0,181
UNTD KINGDOM	BRITISH MIDLAND	1997	0,027	372352,388	125,629	0,607	0,709	0,68	0,066
UNTD KINGDOM	BRITISH REGIONAL	1997	0,029	63783,708	184,277	0,659	0,848	0,837	0,152
UNTD KINGDOM	CITYFLYER EXPRESS	1997	0,062	60207,562	147,375	0,647	0,971	0,971	0,074
UNTD KINGDOM	GB AIRWAYS	1997	0,132	104785,803	436,089	0,575	1	0,953	0,097
UNTD KINGDOM	JERSEY EUR. AIRWAYS	1997	0,033	107006,56	197,857	0,627	0,996	0,976	0,272
UNTD KINGDOM	VIRGIN ATLANTIC	1997	0,082	1092529,883	681,833	0,626	1	0,712	0,186
FINLAND	FINNAIR	1998	0,05	1688406,605	267,266	0,687	0,849	0,654	0,595

GERMANY	LUFTHANSA	1998	0,101	13657322,45	774,826	0,632	0,996	0,54	0,296
IRELAND	RYANAIR	1998	0,229	421645,667	201,388	0,695	1	1	0,628
ITALY	MERIDIANA	1998	0,052	222198,336	276,775	0,675	0,992	0,978	0,264
ITALY	MINERVA AIRLINES	1998	-0,02	18094,457	286,178	0,783	1	1	0,108
SCANDINAVIA	SAS	1998	0,04	4728696,353	211,568	0,57	0,987	0,709	0,42
SPAIN	AIR EUROPA	1998	0,016	191486,594	576,089	0,906	0,381	0,381	0,175
SPAIN	AIR NOSTRUM	1998	0,064	59814,13	131,894	0,755	0,993	0,993	0,024
SPAIN	IBERIA	1998	0,08	3559488,09	260,373	0,559	1	0,792	0,367
SPAIN	SPANAIR S.A.	1998	0,016	149214,564	484,142	0,654	0,403	0,403	0,166
UNTD KINGDOM	BRITISH AIRWAYS	1998	0,063	21461102,1	410,716	0,545	0,993	0,731	0,158
UNTD KINGDOM	BRITISH MED. AIRWAYS	1998	0,037	15318,482	548,387	0,707	1	0,985	0,592
UNTD KINGDOM	BRITISH MIDLAND	1998	0,019	484885,18	110,572	0,624	0,819	0,784	0,05
UNTD KINGDOM	BRITISH REGIONAL	1998	0,029	134705,534	197,129	0,653	0,89	0,884	0,183
UNTD KINGDOM	BRYMON AIRWAYS	1998	0,083	54074,257	111,77	0,627	0,928	0,926	0,179
UNTD KINGDOM	CITYFLYER EXPRESS	1998	0,055	74623,762	159,376	0,659	0,949	0,947	0,113
UNTD KINGDOM	DEBONAIR AIRWAYS LTD	1998	-0,275	34095,709	351,043	0,746	0,763	0,763	0,363
UNTD KINGDOM	EASYJET AIRLINE	1998	0,02	45490,817	335,566	0,694	1	1	0,616
UNTD KINGDOM	GB AIRWAYS	1998	0,198	136773,926	495,68	0,647	1	0,962	0,09
UNTD KINGDOM	JERSEY EUROPEAN	1998	0,046	110762,375	182,343	0,654	0,972	0,955	0,201
UNTD KINGDOM	KLM UK	1998	-0,005	428737,619	149,62	0,67	0,983	0,973	0,055
UNTD KINGDOM	MAERSK AIR	1998	0,017	123604,623	263,127	0,637	0,847	0,818	0,338
UNTD KINGDOM	VIRGIN ATLANTIC	1998	0,108	1353765,191	771,693	0,626	1	0,74	0,154
FINLAND	FINNAIR	1999	0,033	1361569,367	272,678	0,682	0,679	0,485	0,503
NETHERLANDS	KLM	1999	0,003	8224316,614	458,377	0,698	1	0,585	0,208
SCANDINAVIA	SAS	1999	0,007	4824787,786	205,694	0,566	0,984	0,721	0,429
SPAIN	AIR NOSTRUM	1999	0,071	188595,052	124,287	0,737	0,992	0,992	0,006
SPAIN	BINTER MEDIT.	1999	0,029	16254,768	120,162	0,786	1	0,988	0,046
SPAIN	IBERIA	1999	0,009	4275759,872	259,3	0,572	1	0,792	0,289
SPAIN	SPANAIR S.A.	1999	0,019	287623,258	435,966	0,58	0,538	0,49	0,08
UNTD KINGDOM	BRITISH AIRWAYS	1999	0,013	22279485,9	420,044	0,57	0,996	0,722	0,18
UNTD KINGDOM	BRITISH MED. AIRWAYS	1999	-0,018	11786,525	517,794	0,72	1	0,986	0,626
UNTD KINGDOM	BRITISH MIDLAND	1999	0,015	571651,432	117,438	0,671	0,71	0,682	0,043
UNTD KINGDOM	BRITISH REGIONAL	1999	0,041	191035,457	192,178	0,656	0,893	0,888	0,121
UNTD KINGDOM	BRYMON AIRWAYS	1999	0,085	64749,878	105,549	0,694	0,927	0,926	0,648
UNTD KINGDOM	CITYFLYER EXPRESS	1999	0,046	86477,645	178,159	0,667	0,922	0,92	0,101
UNTD KINGDOM	GB AIRWAYS	1999	0,111	101178,457	452,011	0,705	1	0,966	0,057
UNTD KINGDOM	GILL AVIATION	1999	0,011	70286,422	160,231	0,752	1	1	0,096
UNTD KINGDOM	GO FLY LTD	1999	-0,206	80474,41	550,744	0,633	0,992	0,992	0,614
UNTD KINGDOM	JERSEY EUR. AIRWAYS	1999	0,014	128531,023	215,554	0,637	0,893	0,878	0,014
UNTD KINGDOM	KLM UK	1999	-0,047	370997,379	167,724	0,717	0,982	0,973	0,162
UNTD KINGDOM	MAERSK AIR	1999	0,04	145164,279	263,864	0,616	0,798	0,775	0,281
UNTD KINGDOM	VIRGIN ATLANTIC	1999	0,042	1514859,465	821,198	0,681	1	0,737	0,216

Appendix 2

Data for US airlines

Below we present the data and variables for the US airlines we used for the regression. They are presented by years.

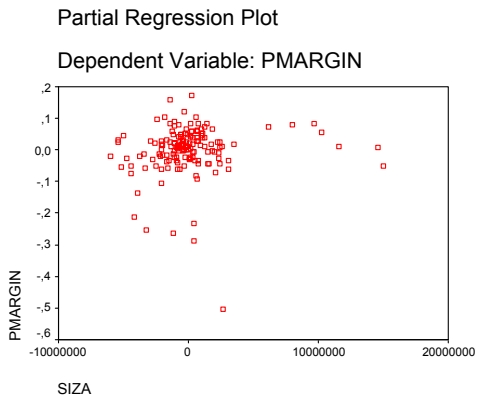
State	Name	Year	Profit Margin	Size	Labor Prod.	Cap. Cost	Share of Scheduled	Share of Passenger	Solidity
US	AMERICAN	1993	0,038	17749121	349,367	0,644	1	0,838	0,56
US	USAIR	1993	-0,019	6809430	245,932	0,668	0,992	0,917	0,406
US	AMERICAN TRANSAIR	1993	0,012	269830	421,532	0,715	0,287	0,287	0,329
US	AMERICA WEST	1993	0,091	1035730	300,951	0,649	0,997	0,927	0,282
US	ALASKA	1993	-0,032	1037546	269,467	0,693	0,987	0,864	0,297
US	CONTINENTAL	1993	-0,009	5099827	330,377	0,627	0,994	0,861	0,354
US	DELTA	1993	-0,022	11641149	385,83	0,636	0,999	0,863	0,354
US	TOWER AIR	1993	0,072	191644	1375,22	0,692	0,596	0,472	0,435
US	HAWAIIAN AIRLINES	1993	-0,034	105386	391,874	0,712	0,995	0,908	0,212
US	NORTHWEST	1993	0,039	8554136	487,399	0,604	0,991	0,72	0,331
US	TWA	1993	-0,08	2915479	263,755	0,617	0,995	0,838	0,134
US	UNITED	1993	0,021	12153325	399,787	0,58	0,998	0,832	0,276
US	ALASKA	1994	0,058	1244985	362,594	0,676	0,988	0,903	0,346
US	AMERICA WEST	1994	0,103	1545092	306,041	0,641	0,997	0,922	0,541
US	AMERICAN	1994	0,061	17815170	385,413	0,615	0,999	0,83	0,508
US	AMERICAN TRANSAIR	1994	0,015	346287	449,092	0,707	0,39	0,39	0,406
US	BUSINESS EXPRESS	1994	-0,041	52173	116,318	0,793	1	1	0,364
US	CARNIVAL AIRLINES	1994	0,019	45836	472,086	0,711	0,813	0,774	0,387
US	CONTINENTAL	1994	-0,018	4276603	313,572	0,657	0,987	0,86	0,405
US	DELTA	1994	-0,017	11343318	395,632	0,628	0,999	0,853	0,34
US	HAWAIIAN AIRLINES	1994	-0,037	163261	359,305	0,713	0,999	0,889	0,45
US	HORIZON AIR	1994	0,05	153646	82,105	0,725	1	0,967	0,658
US	NORTHWEST	1994	0,098	9401951	474,123	0,589	0,992	0,708	0,353
US	TOWER AIR	1994	0,013	177877	856,514	0,681	0,753	0,553	0,508
US	TWA	1994	-0,071	2507013	322,016	0,597	0,995	0,831	0,118
US	UNITED	1994	0,037	11951620	436,228	0,619	0,998	0,837	0,211
US	USAIR	1994	-0,077	6675960	270,277	0,673	0,989	0,923	0,372
US	ALASKA	1995	0,062	1262125	344,607	0,681	0,993	0,914	0,357
US	AMERICA WEST	1995	0,099	1588709	348,593	0,642	0,997	0,928	0,581
US	AMERICAN	1995	0,062	18013971	417,668	0,616	0,999	0,831	0,45
US	AMERICAN TRANSAIR	1995	0,022	413137	433,583	0,731	0,506	0,506	0,411
US	BUSINESS EXPRESS	1995	-0,054	42270	96,74	0,808	1	1	0,342
US	CARNIVAL AIRLINES	1995	0,03	58555	525,855	0,684	0,879	0,769	0,482
US	CONTINENTAL	1995	0,048	4188766	330,401	0,652	0,993	0,879	0,348
US	DELTA	1995	0,083	11942992	397,433	0,637	1	0,857	0,337
US	HAWAIIAN AIRLINES	1995	-0,006	161640	471,236	0,705	0,898	0,782	0,401
US	HORIZON AIR	1995	0,015	154925	91,512	0,752	1	0,967	0,629
US	MID-WEST EXPRESS	1995	0,131	88543	246,478	0,612	0,986	0,86	0,463
US	NORTHWEST	1995	0,102	10695873	453,786	0,653	0,998	0,734	0,468
US	RENO AIR INC	1995	0,033	99484	582,764	0,719	0,916	0,902	0,21
US	TOWER AIR	1995	0,028	210547	782,564	0,607	0,711	0,669	0,471
US	TWA	1995	0,011	2860007	343,087	0,649	0,994	0,845	0,215
US	UNITED	1995	0,056	11392938	437,015	0,623	0,998	0,83	0,255
US	USAIR	1995	0,034	6823527	276,926	0,655	0,989	0,924	0,377
US	ALASKA	1996	0,062	1247900	328,06	0,682	0,995	0,925	0,422
US	AMERICA WEST	1996	0,039	1597676	370,078	0,654	0,997	0,933	0,572
US	AMERICAN	1996	0,088	18104371	436,252	0,643	0,999	0,835	0,42
US	CONTINENTAL	1996	0,072	4419078	286,547	0,636	0,994	0,877	0,376
US	DELTA	1996	0,043	11975293	458,752	0,653	1	0,869	0,303

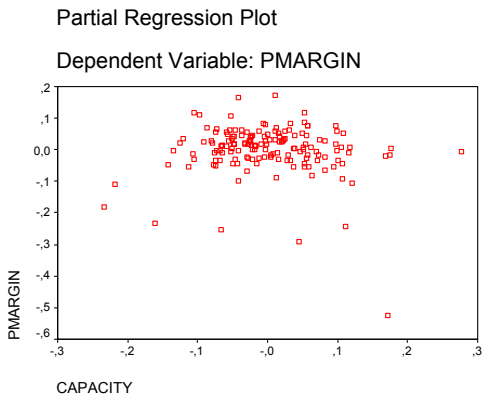
US	NORTHWEST	1996	0,114	11318419	453,2	0,672	0,999	0,755	0,499
US	TWA	1996	-0,056	2690194	340,602	0,632	0,995	0,855	0,285
US	UNITED	1996	0,069	12901588	397,293	0,63	0,999	0,829	0,292
US	USAIR	1996	0,048	7409773	288,552	0,635	0,993	0,925	0,288
US	ALASKA	1997	0,091	1370734	358,16	0,679	0,997	0,929	0,418
US	AMERICA WEST	1997	0,086	1547331	376,595	0,688	0,998	0,931	0,569
US	AMERICAN	1997	0,091	17765116	423,76	0,652	0,999	0,839	0,481
US	AMERICAN TRANSAIR	1997	0,013	466923	363,776	0,726	0,504	0,504	0,226
US	CONTINENTAL	1997	0,101	5410945	343,739	0,652	0,996	0,872	0,382
US	CONTINENTAL EXPRESS	1997	0,15	274772	169,304	0,8	1	0,995	0,171
US	CONTINENTAL MICRON.	1997	0,002	687423	796,816	0,598	0,986	0,76	0,818
US	DELTA	1997	0,114	13113756	439,527	0,638	0,999	0,856	0,402
US	EXECUTIVE AIRLINES	1997	0,093	57809	52,979	0,642	1	0,999	0,002
US	HAWAIIAN AIRLINES	1997	0,005	200824	496,04	0,72	0,858	0,724	0,561
US	HORIZON AIR	1997	0,017	158014	102,083	0,758	1	0,963	0,602
US	MID-WEST EXPRESS	1997	0,123	169078	227,155	0,628	0,99	0,882	0,49
US	MIDWAY AIRLINES	1997	0,081	142112	343,237	0,679	1	0,988	0,489
US	NORTHWEST	1997	0,121	12409779	475,064	0,671	0,998	0,758	0,511
US	RENO AIR INC	1997	-0,026	193409	569,73	0,738	0,915	0,898	0,433
US	TOWER AIR	1997	0,016	310120	871,469	0,658	0,769	0,628	0,266
US	TWA	1997	-0,009	2776902	325,728	0,672	0,998	0,877	0,297
US	UNITED	1997	0,071	16106959	437,015	0,632	0,999	0,809	0,305
US	USAIR	1997	0,069	8265500	288,222	0,622	0,996	0,92	0,384
US	ALASKA	1998	0,123	1548843	368,696	0,677	0,998	0,935	0,448
US	AMERICA WEST	1998	0,1	1594644	358,492	0,656	0,999	0,941	0,598
US	AMERICAN	1998	0,107	19240780	417,774	0,643	1	0,845	0,489
US	AMERICAN EAGLE AIRL.	1998	0,126	940073	77,684	0,723	0,999	0,996	0,277
US	AMERICAN TRANSAIR	1998	0,091	581046	374,684	0,717	0,595	0,595	0,246
US	CONTINENTAL	1998	0,09	6787212	352,559	0,633	0,999	0,869	0,353
US	CONTINENTAL EXPRESS	1998	0,139	328313	156,499	0,772	1	0,997	0,212
US	CONTINENTAL MICRON.	1998	-0,062	525961	614,905	0,532	0,99	0,756	0,662
US	DELTA	1998	0,123	14605811	426,321	0,63	0,999	0,857	0,399
US	HAWAIIAN AIRLINES	1998	0,041	221909	495,966	0,706	0,86	0,731	0,513
US	HORIZON AIR	1998	0,051	187091	119,902	0,742	1	0,971	0,542
US	MIDWAY AIRLINES	1998	0,124	203581	436,912	0,671	1	0,992	0,394
US	MID-WEST EXPRESS	1998	0,15	221414	223,687	0,627	0,995	0,897	0,463
US	NORTHWEST	1998	-0,015	13921100	429,987	0,67	0,999	0,773	0,389
US	RENO AIR INC	1998	0,005	164580	623,331	0,704	0,893	0,875	0,342
US	TOWER AIR	1998	0,035	350762	760,692	0,595	0,845	0,817	0,231
US	TWA	1998	-0,02	2559236	332,438	0,662	0,998	0,9	0,319
US	UNITED	1998	0,082	18829532	437,359	0,633	1	0,807	0,316
US	USAIR	1998	0,116	8796388	293,72	0,595	0,997	0,923	0,414
US	ALASKA	1999	0,104	1981177	355,967	0,689	0,999	0,941	0,31
US	AMERICA WEST	1999	0,091	1663495	422,033	0,678	0,999	0,949	0,59
US	AMERICAN	1999	0,062	21767277	396,331	0,638	0,999	0,841	0,474
US	AMERICAN EAGLE AIRL.	1999	0,052	1375515	90,113	0,726	0,999	0,996	0,213
US	AMERICAN TRANSAIR	1999	0,086	823090	329,722	0,727	0,669	0,669	0,194
US	CONTINENTAL	1999	0,06	8413947	365,978	0,646	0,999	0,862	0,308
US	CONTINENTAL EXPRESS	1999	0,163	359145	184,637	0,804	1	0,998	0,347
US	CONTINENTAL MICRON.	1999	0,06	461856	674,613	0,588	0,995	0,756	0,754
US	DELTA	1999	0,085	19699494	423,41	0,65	0,999	0,856	0,323
US	HAWAIIAN AIRLINES	1999	-0,083	251700	477,981	0,731	0,854	0,732	0,524
US	HORIZON AIR	1999	0,061	212972	123,076	0,732	1	0,975	0,519
US	MESABA AVIATION	1999	0,119	203483	161,103	0,94	1	0,999	0,603
US	MID-WEST EXPRESS	1999	0,145	264207	236,763	0,641	0,996	0,913	0,491
US	NORTHWEST	1999	0,078	13854186	455,211	0,678	0,999	0,76	0,439
US	TWA	1999	-0,104	2140447	361,467	0,654	0,998	0,908	0,315
US	UNITED	1999	0,076	21542952	427,591	0,634	0,999	0,803	0,368
US	US AIR	1999	0,024	9507609	294,287	0,598	0,998	0,925	0,375

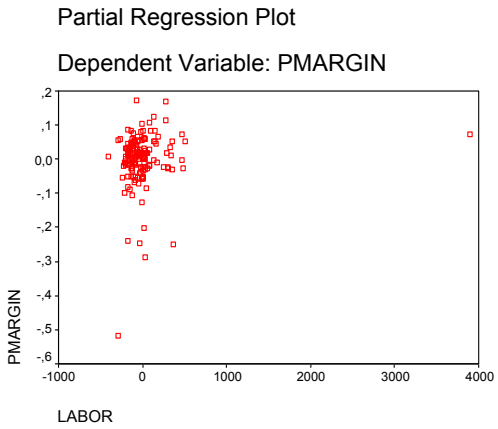
Appendix 3

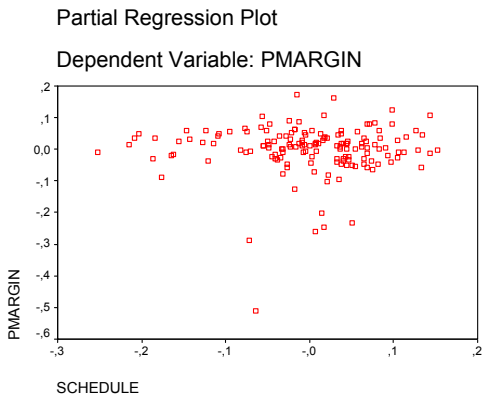
Residual plots for EU airlines

These residual plots are produced in the context of heteroskedasticity. To avoid such a statistical error-term, the residuals should be randomly distributed around zero. Unusual patterns in the residuals would most likely cause an incorrect R^2 in the regression. As can be observed from the plots below, no pattern is visible and the possibility of heteroskedasticity can be rejected among the variables for EU airlines.



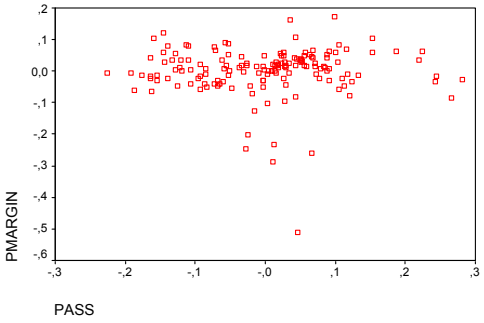






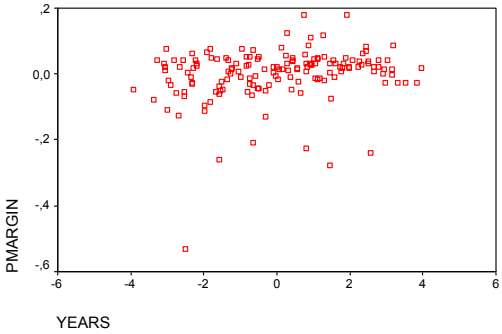
Partial Regression Plot

Dependent Variable: PMARGIN



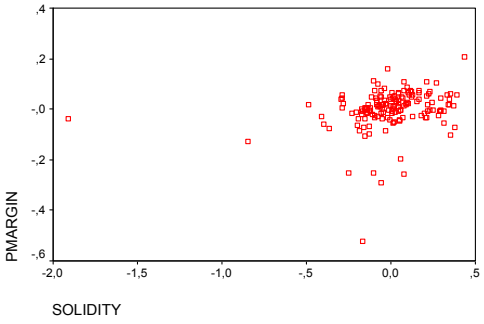
Partial Regression Plot

Dependent Variable: PMARGIN



Partial Regression Plot

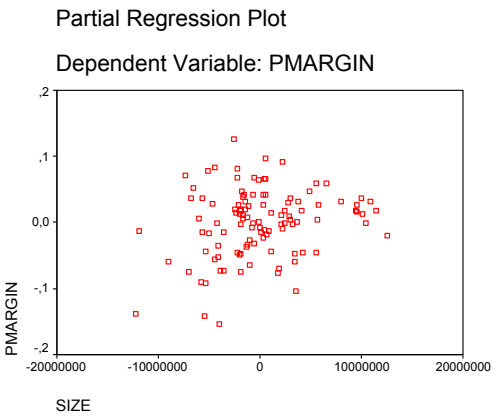
Dependent Variable: PMARGIN

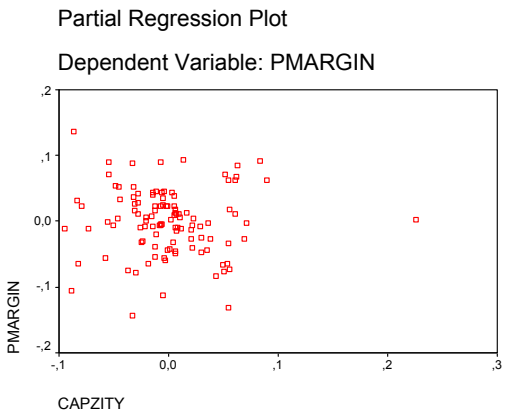


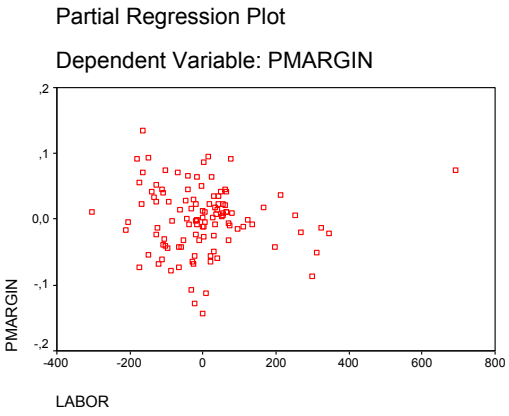
Appendix 4

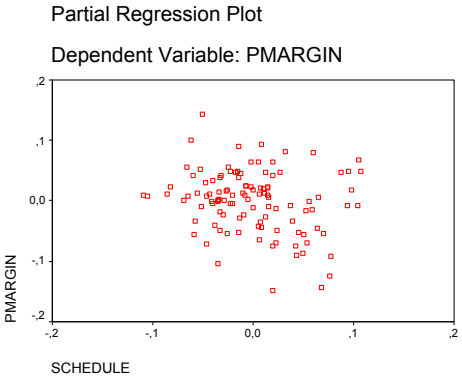
Residual Plots for the US airline data

These residual plots are produced in the context of heteroskedasticity. To avoid such a statistical error-term, the residuals should be randomly distributed around zero. Unusual patterns in the residuals would most likely cause an incorrect R^2 in the regression. As can be observed from the plots below, no pattern are visible and the possibility of heteroskedasticity can be rejected among the variables for US airlines.



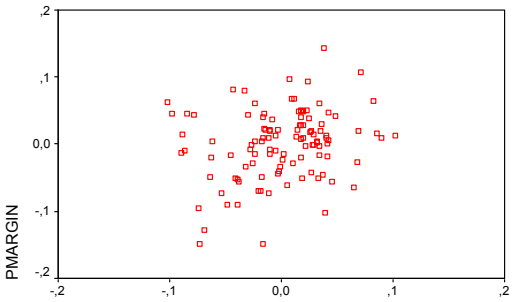






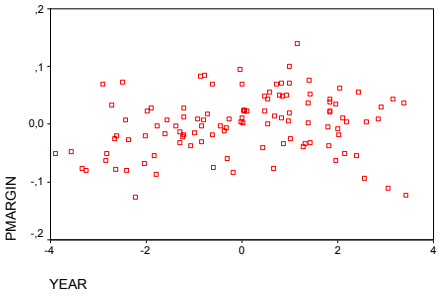
Partial Regression Plot

Dependent Variable: PMARGIN



Partial Regression Plot

Dependent Variable: PMARGIN



Partial Regression Plot

Dependent Variable: PMARGIN